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OPERATIVE GYNECOLOGY

VOLUME I

OPERATIVE GYNECOLOGY

BY

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WITH ELEVEN PLATES AND SEVEN HUNDRED
AND THREE ORIGINAL ILLUSTRATIONS

FOR THE MOST PART BY

MAX BRÖDEL

ASSOCIATE PROFESSOR OF ART APPLIED TO MEDICINE
IN THE JOHNS HOPKINS UNIVERSITY

SECOND EDITION, REVISED AND ENLARGED

VOLUME I

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TO

THE MEMORY OF

ROBERT P. HARRIS, M.D.

WHOSE KINDLY SYMPATHY AND GOOD ADVICE

WERE FROM THE FIRST MY CONSTANT AID

I DEDICATE THIS BOOK

PREFACE.

It is now nine years since the first edition of "Operative Gynecology" issued from the press, and it seems wise to undertake such a revision as will satisfactorily present certain important changes in this field of surgery.

I have improved my work throughout in many details, notably in the first volume in the chapters on Topographical Anatomy and Complete Tear and Relaxed Vaginal Outlet, as well as in those dealing with the Urethra and Bladder and the Ureters and Kidneys. For the benefit of the general practitioner I have added a new chapter on Local and Palliative Treatments as well as chapters on Displacements and Pessaries, and Menstruation and its Anomalies. A new chapter on Bacteriology has been written by Dr. W. W. Ford and one on the Use of the X-Ray in Diagnosis by Dr. F. H. Baetjer. Dr. George Gellhorn has supplied the chapter on Diseases of the Hymen, and the chapter on Inversion of the Uterus has been re-written by Dr. G. W. Dobbin. The sections on Vaginal Glands and on Bartholin's Glands are re-modeled in accordance with recent work of Dr. T. S. Cullen, and I am indebted to Dr. H. W. Cook for the chapter on Anesthesia.

In Volume II a new chapter on Abdominal Extirpation of the Cancerous Uterus, with fifty-six new illustrations, is by Dr. John A. Sampson. The Alexander operation has been fully described, and a new chapter has been added on Gynecological Diseases in Children by Dr. Elizabeth Hurdon.

Dr. Caroline Latimer has given the work her constant care through all the stages of manuscript and press work, a task I could never have accomplished unaided.

Howard A. Kelly.

Baltimore, 1906.

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OPERATIVE GYNECOLOGY.

CHAPTER I.

SEPSIS, ASEPSIS, AND ANTISEPSIS IN HOSPITALS.

1. Sepsis (p. 1).
2. Asepsis (p. 3).
3. Antisepsis (p. 4): Soap and water. Dry heat. Dry-air oven. Steam oven or steam cylinder. Steam. Boiling soda solution. Chemical antiseptics.

a. Operating room (p. 8): Table. Sterilized water. Sterilization and preservation of instruments. Sterilization and preservation of sutures and ligatures. Silkworm gut. Catgut. Gauze and cotton. Iodoform gauze. Sponges. Drainage cushions. Ovariotomy pad. Perineal pad. Vessels.

b. Preparation of surgeon, assistants, and nurses (p. 20): Operating suit. Brushes. Cleansing and disinfecting the hands and forearms. Rubber gloves. Mouth protector.

SEPSIS.

Surgical sepsis arises from the invasion of a wound by pathogenic micro-organisms, which find in the tissues suitable conditions for their development and growth.

The micro-organisms most frequently concerned in traumatic infections are the pyogenic bacteria, of which the most important representatives are the pyogenic staphylococci and streptococci, although under special conditions many other bacterial species may cause suppurative inflammation. The simple conception which once prevailed that a wound becomes infected, in much the same way as an artificial culture medium, by the mere entrance of pathogenic bacteria, has been greatly modified by bacteriological studies of the conditions underlying the infection of wounds. There are various circumstances besides the mere presence of bacteria which determine the occurrence and the character of traumatic infections.

A fresh wound in healthy tissues, while it resembles an artificial culture medium in offering suitable food for the development of many kinds of bacteria, differs from such a medium in the presence of various properties of cells, tissues, and fluids that are hostile to the life and growth of many bacteria. In the study of the causation of traumatic infections it is important to consider, not only the invading micro-organisms, but also the germicidal powers of the cells and fluids of the body. Experiments of Dr. W. H. Welch and others have demonstrated that even the most careful antiseptic or aseptic surgical technique often fails to exclude the entrance of bacteria, even sometimes the ubiquitous pyogenic cocci, into wounds which heal without infectious inflammation. Under these circumstances the antibacterial properties of the living cells and of the fluids of the wounded area suffice to inhibit the growth or the pathogenic manifestations of the invading bacteria. It is largely to these natural inhibitive forces of the living tissues that we must ascribe the good results obtained in many surgical operations conducted even under a bad technique.

It would, however, be a serious error to rely exclusively in surgical technique upon the germ-destroying powers of the living tissues and fluids of the body, great as they undoubtedly are and important as it is not to interfere with these natural germicidal agencies. In a large proportion of the cases in which bacteria have been found in so-called aseptic wounds, the bacteria have either been non-pathogenic or possessed of little virulence. It is exceptional to find virulent pyogenic bacteria in wounds without any manifestations of their pathogenic activity.

The most common invader of wounds of the skin is a variety of the staphylococcus pyogenes albus called by Welch the staphylococcus epidermidis albus (" Conditions underlying the Infection of Wounds," *Trans. of the Congress of American Physicians and Surgeons*, vol. ii), as it is a regular inhabitant of the epidermis and hair follicles. The investigations of Drs. H. Robb and A. A. Ghriskey (*Johns Hopkins Hospital Bulletin,* vol. iii, p. 37, 1892) have shown that most wounds through the skin sooner or later become contaminated with this organism, and yet its presence may not interfere with primary union. An important point relating to the presence of the staphylococcus epidermidis albus in the healthy skin, is that it lies so deeply in the epidermis or hair follicles that chemical disinfection of the superficial layers of the skin does not destroy it, as may be demonstrated by the following experiment: After thorough disinfection of the skin by permanganate of potassium and oxalic acid, in the manner subsequently described, cultures made from scrapings of the surface usually show no growth. If, now, sterilized silk sutures be passed one or more times through the skin in the disinfected area, and a tube of nutrient agar-agar be inoculated with the sutures, the presence of the white staphylococcus, often in pure culture, can be demonstrated in parts of the epidermis deeper than those acted upon by any chemical methods of disinfection of the surface of the integument.

Welch believes that the staphylococcus epidermidis albus is but rarely pyogenic, and that its pathogenic activity depends largely upon decreased resistance in the germicidal forces of the wound area.

The most recent bacteriological and practical experiments on infection of wounds point conclusively to the fact that the skin is a common habitat for various organisms, and that this must be taken into careful consideration in the preliminary disinfection of all operative fields. As already stated, in a large proportion of cases these organisms are non-pathogenic, and a fresh wound containing them may, from a surgical standpoint, be regarded as aseptic when the process of healing is in no way interfered with.

Cultures taken from beneath the most carefully applied surgical dressings very frequently show growths which can be accounted for only on the supposition that bacteria were present before the operation, or were deposited in the wound during the progress of the operation, or gained access later from the adjacent skin. Suppuration occurs when the organism is virulent, the condition of the wound favorable for growth, and the normal inhibitory activity of the tissues reduced.

In the following quotation from Dr. Welch's paper he summarizes the conditions underlying wound infection: "The effects produced in the animal body by the pyogenic cocci are determined by many factors relating to the infectious agent and to the individual exposed to infection. There are differences in these effects, depending upon the species of animal; upon the tissues and parts of the body infected; upon the readiness of absorption from the affected parts; upon the source, the number, and the virulence of the organisms; upon the nature and amount of toxic substances accompanying and produced by the bacteria; upon general predisposing conditions of the body; and upon local conditions in a wound, such as the presence of foreign bodies, of pathological products, of dead spaces, of bruised, necrotic, and strangulated tissues."

Notwithstanding the constancy of micro-organisms in the air and on all objects with which we come in contact, we are usually able, by carrying out a rigid technique, to prevent the invasion of a wound by virulent pyogenic organisms in sufficient number to produce harm. The realization of the difficulty of obtaining a germ-free wound should stimulate surgeons to observe the most painstaking care in the preliminary preparation, in order to reduce the amount of contamination to a minimum.

ASEPSIS.

In a surgical sense asepsis is the absence of septic germs; an aseptic wound is one which remains free from invasion by these germs in sufficient number to disturb the healing process.

The common means for the introduction of the germs are the hands of the surgeon or of his assistants, the instruments, or the surgical accessories.

The surface of the body, the digestive canal, and the female genital tract up to the internal os uteri are normally the habitat of many species of micro-organisms. As it is not practicable to differentiate beforehand the specific character of the various germs which are present, especially as to their pyogenic properties and virulence, modern surgery first, proceeds upon the assumption that the skin of the patient, of the surgeon, and of the assistants, the instruments, the dressings, etc., are in an infected state until rendered aseptic by the use of antiseptic measures; and second, endeavors to maintain the aseptic condition thus established throughout and after an operation.

The surgeon must also be constantly alive to the fact that his work and that of his assistants and the nurses may bring them into daily contact with septic matter, and that extraordinary precautions are necessary to avoid conveying such infected material from case to case. There is a well-recognized liability of septic cases to occur in groups in hospital practice. As an example of this in my own case, in 1892 I ruptured a large streptococcus abscess in removing it, and the patient died shortly afterwards. Three cases immediately following this had an erysipelatous inflammation of the wound and narrowly escaped with their lives.

ANTISEPSIS.

Antisepsis is a term used to designate any active means whatever by which septic germs are removed, destroyed, or rendered inactive.

The antiseptic principle may be worked out in a variety of ways. The demonstration, however, of the value of any antiseptic procedure must come through the more rigid scientific methods of the bacteriologist, and in all cases of innovation as to ways and means his experiments must be recognized as the authoritative tests.

The mechanical removal of germs by scrubbing with soap and water, and their destruction by steam or boiling solutions, are the best antiseptic agents which we possess. It is a noteworthy fact that the housewife's simple remedies against dirt and against fermentation, as in preserving fruits, appear to be the final outcome in this direction of the surgical activity of the last half of the past century.

The usual methods of applying heat as a germicide are the hot dry-air oven, the steam oven, the steam cylinder, and boiling soda solution.

Hot-air disinfection requires too high a temperature—176.6° C. (350° F.)—to be satisfactory for most purposes, and is also injurious to sharp instruments. I have for this reason abandoned it in favor of steam disinfection.

Steam disinfection in an oven, jacketed to prevent the steam from condensing, destroys the most resistant organisms.

In order to destroy all germs with their spores, sterilization by live steam must be repeated for two or more successive days, an hour the first time and half an hour on each subsequent occasion. The spores of pathogenic bacteria are less resistant than those of some saprophytic bacteria, such as the bacillus subtilis, and the former are destroyed by exposure for half an hour to the temperature of live steam. Steam under pressure of ten to fifteen pounds destroys even the most resistant spores by a single exposure for from twenty minutes to half an hour.

The Arnold or E. Boeckmann steam sterilizer, or some sterilizer similarly constructed, is cheap and effective. The steam is generated rapidly in a small, hollow plate by a Bunsen flame, and then passes through a short shaft into a jacketed cylinder containing the articles to be sterilized. Circulating from this under an outside copper jacket which covers the whole, it is recondensed and drips into a pan, from which it runs through small holes into the hollow plate, and begins to travel the circuit again.

Institutions supplied with steam heat may convey the live steam directly into the sterilizers—a practical, effective, and rapid means of sterilization. An apparatus long in use in the gynecological operating room of the Johns Hopkins Hospital, connected in this way with the general steam-heating system, has proved most satisfactory.

Two sterilizers are employed—one for water, the other for dressings, etc. The sterilizer for dressings consists of a cylindrical copper reservoir containing a steam coil, which enters from above and has its exit from below. The bottom slopes toward the center, forming a shallow funnel with a drainage-tube for the escape of the condensed steam. A wire netting is placed two inches from the bottom, upon which the objects to be sterilized are deposited. The circulation is so arranged that when active sterilization is required live steam can be turned into the cylinder, penetrating the linen envelopes of the dressings and the cotton plugs of the flasks and tubes.

When the sterilization is completed the live steam is turned from the reservoir into the coil by simple gate-valves, and so the dressings dry quickly before they are removed from the sterilizer. In order that the drying process may be facilitated, the cover should be lifted and air allowed to enter.

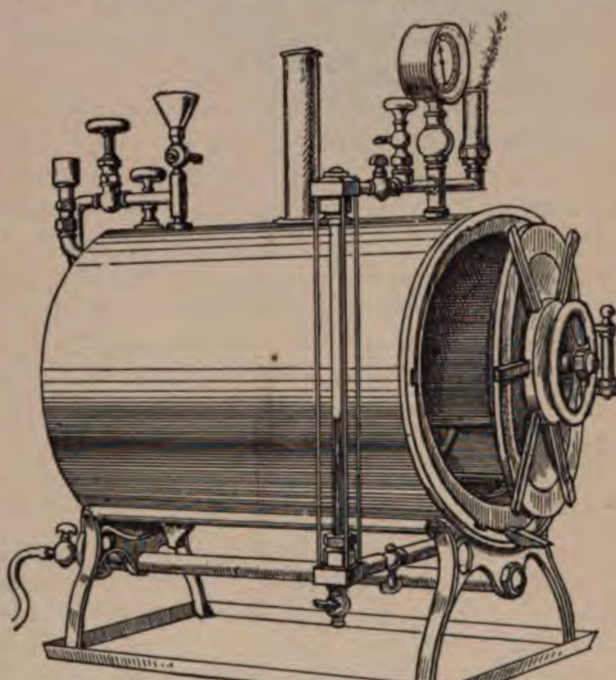

Fig. 1.—Steam Sterilizer for Dressings and Dishes, the door partly open.

When the dressings are put in and the door closed, a slight turn fixes the projecting lugs in under the rim; the ring in the center of the door is then revolved until the door is jammed down and a steam-tight joint secured. The steam is generated in the jacket by a long gas jet or steam pipes underneath. The amount of water in the jacket is indicated by the gauge at the side. The steam gauge on top registers the pressure inside the chamber. After heating and exhausting the air in the sterilization chamber the steam is let in by a screw and the sterilization begins. At the completion of sterilization the steam is turned off and the dressings in the boiler thoroughly dried before removal.

Steam sterilization under pressure is more rapid and more effective than that conducted without it. One of the latest and best sterilizers on this plan is the Sprague, manufactured by Richard Kny & Company, constructed on the principle of the autoclave used in the bacteriological laboratory.

The apparatus consists of an inner and an outer cylinder, the outer serving as a jacket for the inner one. The sterilizing chamber is barrel-shaped, and is closed by a secure door, which makes it steam-tight. A steam gauge indicates the pressure, which may be carried up to thirty pounds, and a safety valve is security against explosion.

Before beginning the sterilization a small quantity of water is placed in the outer cylinder, after the inner cylinder has been packed with the objects to be sterilized. The door is then closed and screwed down securely. The gas jet is lit under the cylinder and steam quickly generated, which passes up around the inner cylinder, where it enters a pipe on the top, to be conducted down beneath the perforated rack which supports the dressings; it then passes on, up through the middle of the cylinder, and so through a vent into the outer cylinder.

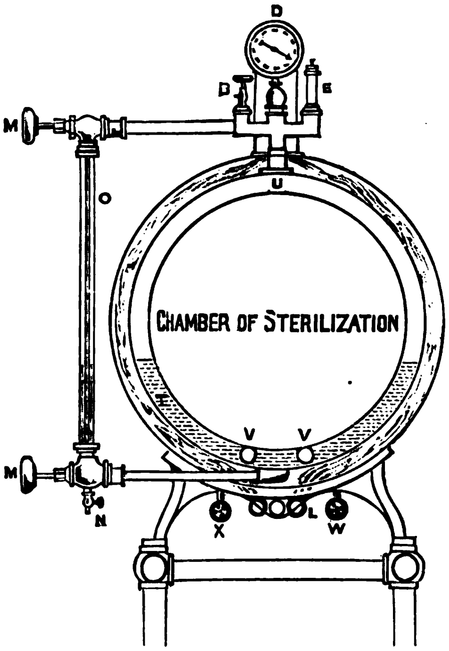

FIG. 2.—SECTIONAL VIEW OF STERILIZER FOR DRESSINGS AND DISHES, WITH STEAM IN CENTRAL CHAMBER UNDER PRESSURE.

B is valve for the discharge of air displaced by the water; *D* is pressure indicator; *E* is the safety valve; *M*, *M* are valves connected with water gauges; *N* is the draw-off valve, water from jacket, for cleansing purposes; *O* is glass water gauge; *U*, steam space in jacket; *V*, *V*, coils for heating water, using steam from the general plant of an institution; *W*, steam inlet valve; *X*, outlet valve, condensation from coil; *L*, gas: *T*, water.

When the sterilization is completed a valve is opened and the air enters, quickly drying the small amount of moisture collected on the dressings.

In this way we can conveniently sterilize in the chamber, which measures 20 inches in diameter by 28 inches or more in depth, silk ligatures, dressings of all sorts, dishes, operating suits, visitors' gowns, sheets, towels, napkins, and blankets.

Boiling Soda Solution.—Boiling water containing 10 grams (150 grains) of powdered carbonate of soda to the liter, is the best antiseptic for instruments, because it dissolves the capsule of the germs and destroys them within five minutes, while simple boiling water and steam demand a much longer time. The soda solution also has the great advantage of preventing rust.

A convenient vessel for boiling instruments is a long, narrow tin bath or a porcelain fish boiler, 5 to 7 cm. (2 to 3 inches) deep, containing a tray for holding them during immersion. A row of Bunsen burners beneath the boiler raises the water to the boiling point in two or three minutes, and in five minutes more the sterilization is complete.

As a fixture in an operating room it is convenient to employ a receptacle, rectangular in form, measuring 15 inches in length by 8 inches in width and 6 inches in depth, made of sheet bronze, polished on the outside, and coated internally with pure tin, over which a coating of nickel is deposited. The oval cover of the vessel opens on "slip hinges," and two perforated metal trays hold the instruments in the sterilizer. The instruments are immersed in a 1 to 2 per cent solution of the carbonate of soda, which is brought to the boiling point and kept there for from five to ten minutes.

The boiler is arranged for heating either by gas or by steam.

Chemical Antiseptics.—As far as possible, it is safer to depend upon steam or heat sterilization than upon chemicals.

Experiments have shown that the solution of bichloride of mercury, frequently employed in surgical work, does not manifest its germicidal powers under all conditions. It often merely inhibits germ growth, and to what extent this inhibition is valuable is as yet unknown. The inefficiency of bichloride of mercury as a cutaneous germicide can be tested for practical purposes by immersing the hands for ten minutes in a 1–500 aqueous solution, and then in a sterilized ammonium sulphide solution to precipitate the mercury. After this, by scraping the epithelium, cultures can usually be obtained which will grow in ordinary media.

If dishes and porcelain ware are to be efficiently sterilized by this means, they must be kept in a strong solution of corrosive sublimate (1–500) for fifteen minutes after they have been thoroughly scrubbed with soap and water; the sublimate kills most of the bacteria and renders the rest inactive. Decidedly the best way to sterilize dishes is to put them into the large steam sterilizer along with the operating suits, towels, sheets, and gauze, and subject them to the same process of sterilization.

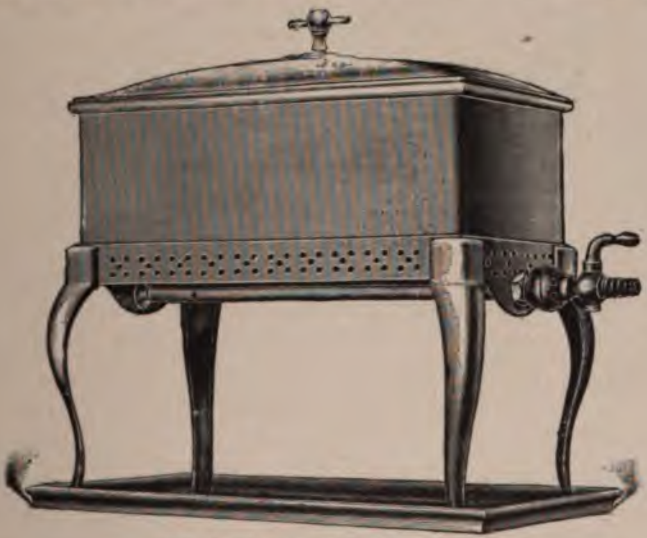

FIG. 3.—INSTRUMENT STERILIZER.

In the experiments on skin disinfection we have to consider a factor which we do not encounter in the sterilization of the dishes. The albuminate of mercury which is formed in the tissues, when brought in contact with corrosive sublimate solutions, may incapsulate the organisms, and so render them incapable of growth. When dishes, on the other hand, are submerged in the disinfectant solution, the organisms are at once brought in contact with the bichloride of mercury without the formation of this albuminate, and the sterilization is more effective.

The use of chemical solutions, such as carbolic acid and corrosive sublimate, for disinfection of wounds is objectionable, because their value depends upon the strength of the solution, and a solution of sufficient strength to act as a germicide acts as an irritant. Dr. W. S. Halsted has shown that the irrigation of fresh wounds with a corrosive sublimate solution as weak as 1–10.000 is followed by a distinct necrosis demonstrable under the miscroscope. This necrotic material may retard the healing process and act as a culture medium for any germs deposited in the wound subsequently: the danger of acute poisoning from the absorption of the mercury must also be considered.

I have long since given up the use of carbolic acid solutions for instruments, and only use sterilized water in which to submerge them during operation. The germicidal effect of carbolic acid solutions is more than counterbalanced by the injury which it causes to the hands. I have seen the hands so badly cracked and chapped by the carbolic solutions that it was impossible to scrub them perfectly with nail brushes.

THE OPERATING ROOM.

For private hospitals or small public institutions the best form of operating room is a simple, spacious, rectangular structure, well lighted by skylight and northern windows. The various architectural details should be so arranged as to facilitate the work for which the room is designed, and to carry out the principles governing surgical procedures. The doors should be of the noiseless sliding kind, so as to offer no obstruction to the easy transportation of patients to and fro. Any elaborate ornamentation of the room must be avoided. The walls must be smooth, or hard finish, or coated with enamel water-proof paint, to resist the disintegrating action of steam. The cleansing of the walls and floors is helped by rounded angles. The walls may be paneled with broad slabs of African marble, which extend five feet up from the floor as a wainscot, or, as in some clinics, all the way to the ceiling. There are several kinds of material useful for flooring; the most common are the square encaustic tiles and the mosaic blocks. When properly laid, so that there are no crevices or cracks, either of these makes a serviceable and ornamental floor. In paving the floor with the blocks, care must be observed to secure a uniform smoothness over the entire surface. By mopping the floor daily and scrubbing it twice a week with sapolio its surface is kept clean. Where economy in construction is considered, a cement pavement or one of bolted boiler iron covered with ship's paint makes a good floor, which can be easily kept clean. The floors of some operating rooms are laid to slope toward the center or toward one corner of the room, where there is a drainage vent; this convenience would appear to be more dangerous than useful, for the waste pipe may become clogged.

Ventilation must also be considered, for, while we do not attribute so much risk to contamination from the air as formerly, we dare not ignore the fact that infection may occasionally be carried in this way. The entrance for fresh air and the exit for impure air should be so placed that the circulation will not be conducted over the operating table. This precaution is further necessary on account of the possibility of chilling the patient.

The ventilators should be so set that they can be easily taken out of their sockets and cleansed, and some filtering material may be placed in the ventilators.

A sloping skylight, looking to the north, gives an evenly distributed light, which is never glaring.

The equipment of the operating room must be simple.

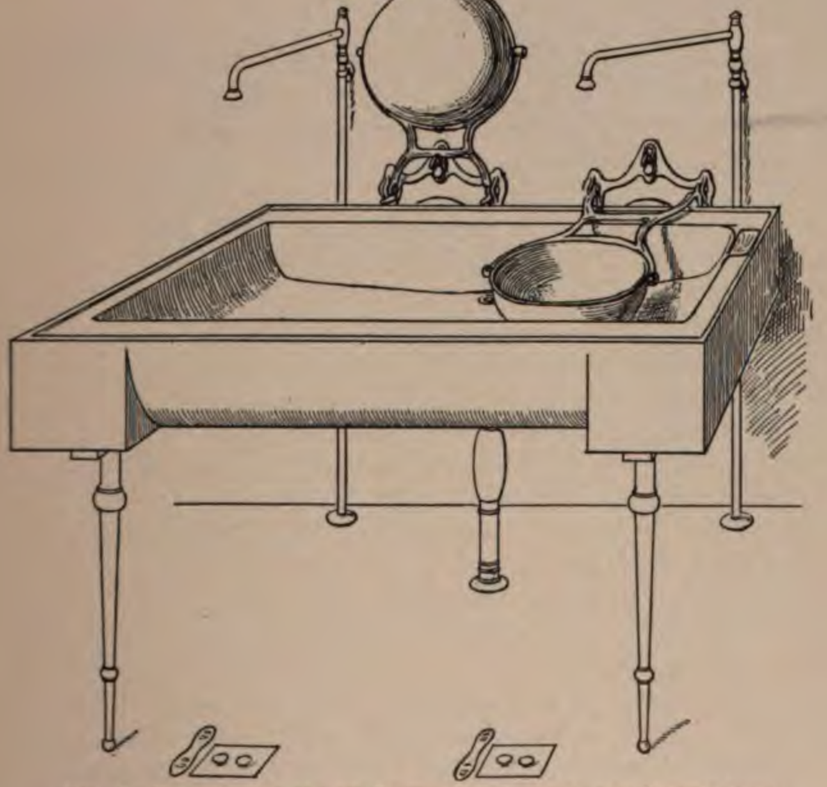

Fig. 4.—Hand Basins set on Pivots for Removal and Sterilization.

The hot and cold water are mixed in a rose jet a foot above the basin. The flow of hot or cold water is controlled by the foot taps on the floor.

A prime requisite is a row of large, oval marble basins plentifully supplied with hot and cold water. To facilitate the most perfect details of the aseptic principle, the taps ought to be connected with a pedal attachment which permits the water to be turned on or off by the foot.

The credit for this invention belongs to Dr. Hunter Robb. It was first employed in my private hospital in Baltimore, and is now used in almost every clinic in the world.

The most glaring inconsistency in the aseptic arrangement of most operating rooms is the impossibility of thoroughly sterilizing the hand basins, which are contaminated at every washing and are liable to hold grease. This may be avoided by using movable metal basins made of plated copper or solid nickel, and swung over a porcelain hopper or sink, as shown in the figure.

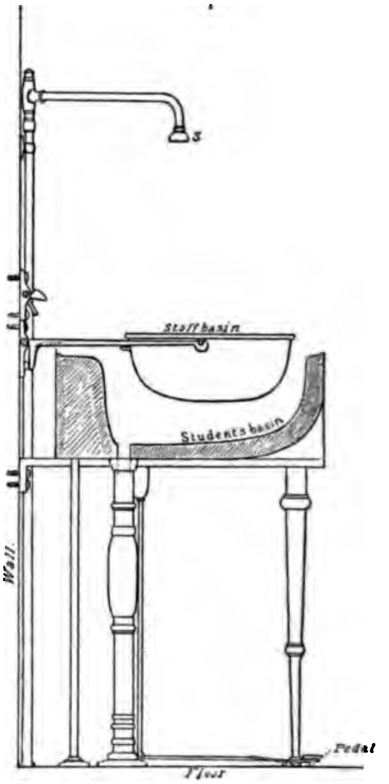

FIG. 5.—SIDE VIEW OF SAME, SHOWING MOVABLE BASIN SUSPENDED ABOVE, "STAFF BASIN"; BELOW THIS IS BASIN USED BY STUDENTS.

F. F. Simpson, of Pittsburg, Pa., has devised a surgical washstand in which the basin swings on axles, and can be tilted and emptied by means of a lever moved by the foot, similar to those employed to control the hot and cold water. This arrangement does away with the necessity for touching any part of the wash apparatus with the hands.

A large sink for the immersion of dishes, etc., and a hopper for waste water, should be in a convenient location. The traps in all the pipes must be inspected and disinfected frequently.

The room should be fitted with electric-light and gas fixtures, and an electric-light bracket should be placed near the operating table, so that a portable light with reflector may be easily attached. A group of four incandescent lights with reflectors should be suspended over the table.

The other furnishings of the operating room should be as few as possible; all apparatus—such as dressings, sterilizers, water-boilers, etc.—should be placed in an adjoining room. The instrument case should be conveniently located, either near the operating table or in an adjoining room, so that an instrument may be quickly obtained if required at any time in the midst of an operation.

Glassware for instruments and solutions, and jars for sterilized ligatures, gauze, cotton, and towels, are kept in a room especially set aside for storage.

The sterilization of instruments, dressings, etc., should not be done in the operating room, as the combustion products vitiate the atmosphere, and during the summer months the temperature of the room becomes excessive with the additional heat.

The anesthesia room should be conveniently placed, but great care must be observed to have it so planned that noises from the operating room will not be heard by a waiting patient.

Operating Table.—The gynecological operating table should be of metal with a movable glass top, which can be raised or lowered as required.

The Boldt table shown in the figure is one of the most satisfactory on the American market. Its simplicity is such that its mechanism can readily be understood by consulting the figure. When the patient is elevated in the Trendelenburg position the shoulder supports should be well padded to prevent injury to the nerves of the neck.

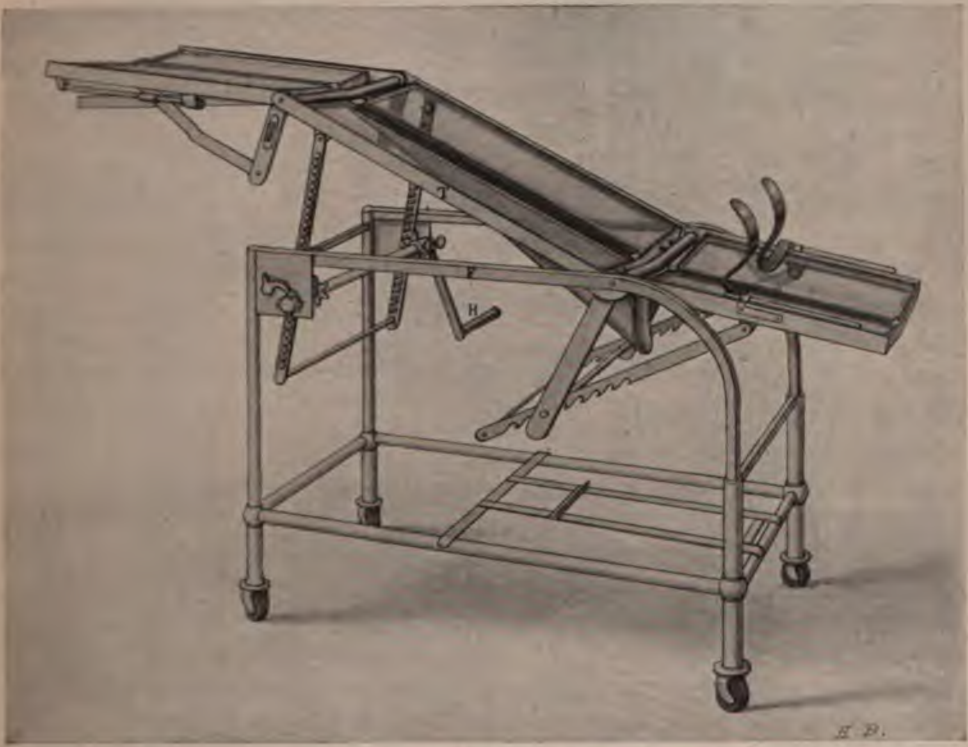

FIG. 6.—BOLDT'S OPERATING TABLE, ELEVATED IN THE TRENDELENBURG POSITION.

At the left hand is seen the simple ratchet attachment for raising the foot. The patient is kept from sliding down by the shoulder braces above, on the right. Drainage is provided for by the slight inclination of the glass plates, discharging into the metal trough in the center.

Edebohls' table, one of the simplest and best constructed, and the Boldt table, which inclines the whole body, are both well arranged for self-drainage and easy adjustment.

Sterilized Water.—An abundant supply of sterilized water should always be on hand in the operating room. Water drawn from the tap can be sterilized by boiling it for half an hour. If it is allowed to stand covered for several hours after boiling, the organic matter settles to the bottom, and the clear water above this can be drawn off by a spigot placed in the vessel about 10 cm. (4 inches) from the bottom. A ready method of sterilizing water in a clinic is by means of a copper reservoir lined with a steam coil. To use this, fill the reservoir with water, and then open a valve in the coil letting in the steam, when the water is quickly brought to a boiling point. Another way of getting sterile water is by distillation; water can be distilled in quantity, from 80 to 120 liters (20 to 30 gallons) daily, by means of a gas flame, running water, and a small copper still hung on a bracket against the wall. The cold-water faucet taking its supply from the street, is connected with the still by a rubber tube, and a slow flow started; a Bunsen burner beneath the still condenses a small portion of the water passing through it, and in this way 6 to 8 gallons, or more can be secured every twenty-four hours. The distilled water is conveniently stored in large agate-ware pails and boiled as required for use.

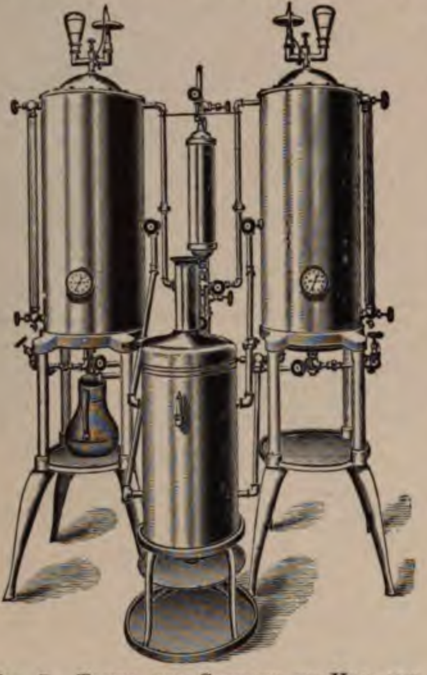

FIG. 7.—TANKS FOR STORAGE OF HOT AND COLD WATER.

In a large clinic the quantity of sterilized water, both hot and cold, which is needed for daily use is so great that an apparatus such as that shown in Fig. 7 is a great convenience.

The water, entering from the house tap, is first filtered in the narrow cylinder between the two large ones, to remove all visible impurities. It is then boiled, either by a gas engine, below in the center, or by steam coils, and stored in the large reservoirs seen at the sides, holding from 60 to 75 gallons or more, so arranged that one holds hot and the other cold water. Gauges show the amount of water in the tanks, and thermometers register the temperature. The water is drawn mixed at the desired temperature. Air-filtering vacuum valves above the cylinders provide for the entrance of pure air as the water is withdrawn.

Sterilization and Preservation of Instruments.—It is but a few years since the care of the instruments amounted to nothing more than washing them, often hurriedly, with soap and warm water, and putting them away in a velvet-lined case, ready for use at the next operation. A close observer could then frequently detect dried blood clinging to the joints of forceps and scissors, and dirt lodged in the eyes of the needles.

No part of the gynecological technique is to-day considered more important than the sterilization of the instruments. To facilitate cleansing, a preference must always be given to the simplest forms of instruments; joints, corrugations, and rough surfaces on the handles must be avoided whenever possible. In the locks of scissors and forceps the screw joint must be rejected, and in its place the French lock, or one similar to a device of my own, is recommended.

After an operation the instruments are gathered together, the paired instruments, such as forceps and scissors, separated, and knives and needles laid apart. They are then placed with handles together in a large dish and washed with soap and hot water. If tarnished, they may be polished with the best grade of sapolio. The first assistant lifts up one instrument after another, rinsing it and wiping it clean; he hands it to the second assistant, who dries it, inspecting carefully all its parts before placing it on a clean dry towel spread on a table. When all the instruments have been cleaned, they are classified and put away in the instrument case on glass shelves to await the next operation. After septic operations, dealing with purulent peritonitis, abscesses, sloughs, etc., the instruments, in addition to being washed, must be sterilized before being returned to the case. By using water not far from the boiling point in cleansing them, the instruments become so hot that they dry much more rapidly.

Before every operation the proper instruments are selected and placed in a bag or wrapped in a towel, and laid on a tray for sterilization for five minutes in a 1 per cent carbonate of soda solution, as devised by C. Schimmelbusch. When lifted out of the solution they are placed in glass dishes on a table close to the operating table, where they are classified by an assistant whose hands have been sterilized; they are then covered with hot water. One of the great advantages of the soda solution is that it does not tarnish and dull the edges of the instruments as steam sterilization does. Such glaring inconsistencies as drying the instruments with a soiled towel or taking them up with unclean hands must be avoided. Instruments taken out of the case for inspection by visitors must be laid aside for sterilization before being returned.

Only the sterilized hands of the operator and his assistants should come in contact with the instruments used during the operation. An instrument which falls to the table or floor, or touches garments or face, is septic until resterilized.

Sterilization and Preservation of Ligatures and Sutures.—Silk and silkworm gut are sterilized by the fractional method.

The best quality of surgeon's twisted silk must be secured in three sizes: fine (No. 2), intermediate (No. 3), and heavy (No. 4). The fine silk is used to make the carrier loops in the needles and for intestinal suture. The intermediate silk is used, in general, to tie vessels, to bring together wound surfaces, and often to tie small pedicles. The stout ligature is only used in tying a large quantity of tissue in a pedicle.

FIG. 8.—THREE SIZES OF SILK USED—FINE, INTERMEDIATE, AND HEAVY.

The following method of sterilizing silk we owe to Dr. W. S. Halsted, of the Johns Hopkins Hospital: The skeins of silk are opened and cut in lengths of 45 cm. (18 inches) for carriers, and 35 cm. (14 inches) for ligatures and sutures. Ten of these are wound on a glass reel, and several such reels of one size, or of assorted sizes, are dropped into a stout glass ignition tube, devised for this purpose; several of these tubes, plugged loosely with cotton, are put in a steam sterilizer for an hour the first day, and on the two days following for half an hour each time. The steam passes through the cotton without restraint, and acts upon the silk as easily as if it lay loose in the sterilizer. On removing the tubes, the cotton in the mouth is pushed tightly in and they are stored away in glass jars until wanted. Silk which remains over after an operation may be resterilized in the same way, but it is apt to be weakened after the second sterilization.

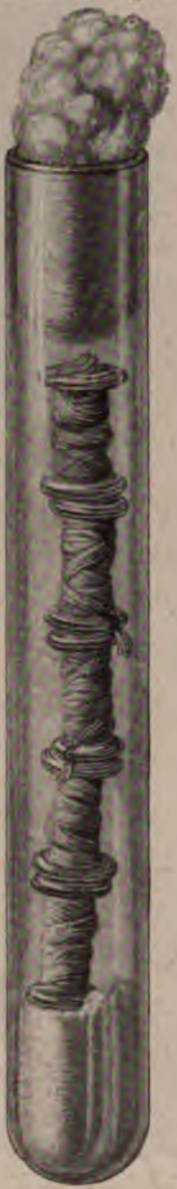
FIG. 9.—ROLLS OF STERILIZED SILK THREADS ON GLASS BOBBINS PRESERVED IN STOUT GLASS IGNITION TUBES. ¾ ORDINARY SIZE.

Instead of using a receptacle such as is figured here, another plan, equally economical and satisfactory, may be adopted of employing stout glass tubing, cut in suitable lengths, and plugged with cotton at both ends.

If it is necessary to take but one reel of silk out of a tube, it may be done without contaminating the rest by carefully removing the cotton stopper between the third and fourth fingers, taking care that the surface of the cotton which comes in contact with the tube does not touch anything else, while holding the tube obliquely to facilitate removing the reel with a pair of sterilized forceps.

Silkworm Gut.—To sterilize silkworm gut, a dozen pieces or more are loosely twisted together, doubled, and put into an ignition tube or a piece of ignition glass tubing plugged at both ends, and sterilized in the same way as the silk.

Catgut.—The employment of catgut sterilized by defective methods has, in at least three recorded instances in my own practice, been productive of serious outbreaks of infection. That the majority of methods are unsafe is shown by the great number proposed. From 1890 to 1894 I used catgut prepared by soaking in ether and then boiling in alcohol under pressure. The results from its use were good until the beginning of 1894, when an outbreak of sepsis occurred which caused four deaths, and while we had no direct bacteriological evidence against the suspected catgut, which had been used in all the cases, circumstantial evidence was so strong as to leave little doubt as to its rôle. Catgut was therefore given up entirely, and was not used again until 1895, when I adopted Krönig's cumol catgut.

Briefly stated, Krönig's method consists, first, in the gradual heating of the catgut at 70° C. for two hours, to drive off the hygroscopic water; second, heating in cumol to a temperature of 165° C.; third, transferring to benzin, where it may remain until ready for use, or whence it can be transferred to Petri dishes.

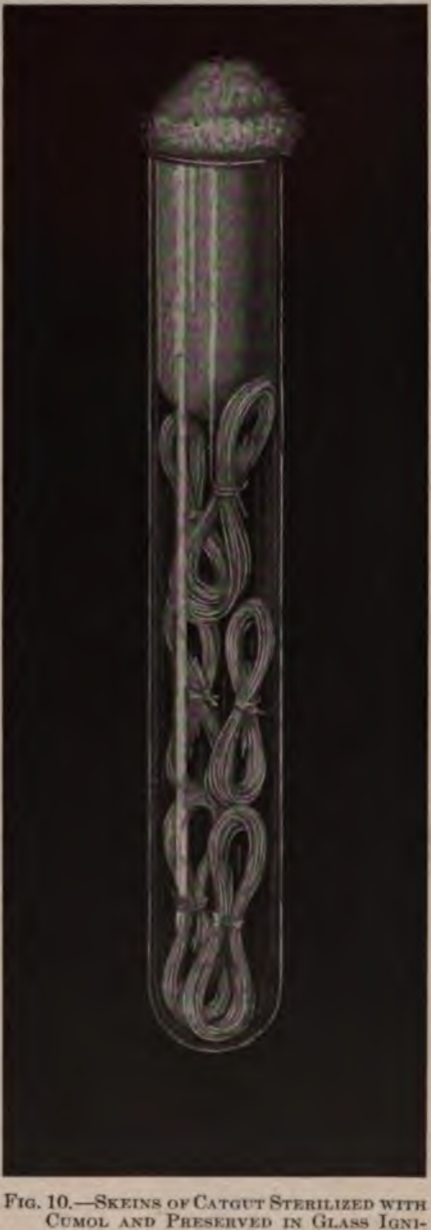

Fig. 10.—Skeins of Catgut Sterilized with Cumol and Preserved in Glass Ignition Tubes. ¾ ordinary size.

The experiments made by Drs. Clark and Miller, of the Johns Hopkins Hospital gynecological staff, demonstrated beyond doubt the correctness of Krönig's method in general, but showed that it was defective in that the catgut was transferred to benzin, which is not always sterile. It was therefore possible that the suture material might become reinfected by the benzin. As a result of their experiments the following modified method has been adopted:

1. Cut the catgut into the desired lengths and wind twelve strands into a figure-of-eight form, so that it may be slipped into a large test tube.

2. Bring the catgut gradually up to a temperature of 80° C., and hold it at this point for one hour.

3. Place the catgut in cumol, which must not be above a temperature of 100° C.; raise it to 165° C. and hold it at this point for one hour.

4. Pour off the cumol and either allow the heat of the sand bath to dry the catgut or transfer it to a hot-air oven, at a temperature of 100° C., for two hours.

5. Transfer the rings with sterile forceps to test tubes, previously sterilized as in the laboratory.

In making the catgut up into skeins it is only necessary to tie the ends in the isthmus of the figure-of-eight to hold them securely in proper shape. If convenient, it is better to use the hot-air oven for the drying process, but this is not absolutely essential, for a sand bath can be improvised, as suggested by Krönig, to serve this purpose. A beaker glass of at least a half-liter capacity is embedded three-fourths of its height in a tin or agate-ware vessel of sufficient capacity to permit three-fourths of an inch of sand to be packed about the sides and beneath the glass.

In drying or boiling, the catgut should not come in contact with the bottom or sides of the vessel, but should be suspended on slender wire supports or placed upon cotton loosely packed in the bottom. During the drying process the beaker glass is covered with a sheet of pasteboard, through which a centigrade thermometer is thrust, so that the mercury bulb may be suspended about midway in the vessel. In this way the temperature can be perfectly regulated. A Bunsen burner is placed under the sand bath and the temperature in the beaker glass is slowly brought up to 80° C., where it is held for one hour to dry the catgut. A higher temperature than 100° C., before the catgut is thoroughly dry, renders it brittle; this step in the method must be carried out most carefully. When the drying process is completed the cumol is poured into the beaker glass and brought up to a temperature of 165° C., a little short of the boiling point, with two Bunsen burners. A copper-wire netting should be placed over the beaker glass to prevent the ignition of the cumol. This temperature is more than sufficient to kill all micro-organisms, and it is not desirable to allow the cumol to boil, as boiling causes unnecessary evaporation. The catgut is left for one hour at this temperature, when the cumol is poured off for subsequent use.

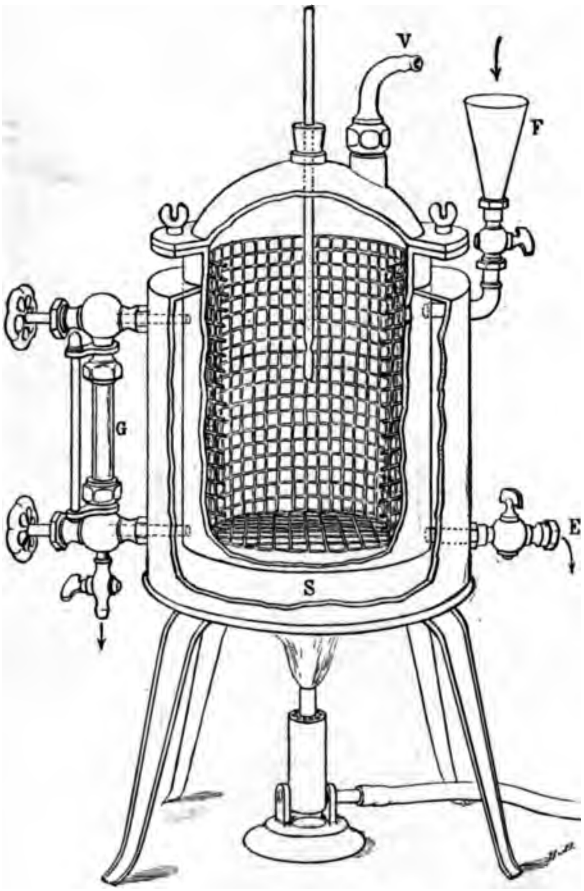

FIG. 11.—J. G. CLARK'S CUMOL STERILIZER.

E, tap for removing cumol from cylinder; F, funnel through which cumol is poured into cylinder; G, glass tube connected above and below with cylinder to show the amount of cumol; S, sand between outer and inner vessels; V, vent.

Cumol, which is of a clear, limpid, slightly yellowish appearance when procured from the chemist, is changed to a brownish color by boiling.

The catgut is allowed to remain in the sand bath until the excess of cumol is driven off and it appears entirely free from any oily matter. A period of one to two hours is usually sufficient to dry it thoroughly.

From the sand bath or hot-air oven it is transferred with sterile forceps to sterile test tubes, such as are used for culture media, in which it is preserved from contamination until ready for use. Small quantities should be placed in each tube, to obviate the necessity of opening them too frequently.

In conclusion, it is well to bear in mind that while cumol is not explosive, it is very inflammable, and great care should be observed in lifting the wire screen from the beaker glass, to prevent drops of the cumol from falling into the flame, or on the heated piece of metal on which the sand bath rests, as it will take fire, flare up, and ignite the fluid in the beaker glass. Such an accident has occurred three times in our experience, and several deaths have been caused by it in other clinics.

Catgut may be securely sterilized with perfect safety by using the following apparatus constructed by Dr. J. G. Clark with the aid of Mr. A. V. M. Sprague. The materials are brass and copper, brass for the cast parts and copper for the cylinders. A cylindrical vessel of copper, 5 inches in diameter and 8 inches in height, is fixed within a similar larger cylinder, so as to leave a space of one inch between the two on all sides and at the bottom. This space is compactly filled with dry sand. The apparatus is supported on legs raising it 6 inches above the tray on which it rests. The upper end terminates in a bronze, metal-flanged top, upon which rests a dome head of cast bronze. The head is bolted tightly to the body of the apparatus, but may be quickly removed so as to reach the interior. The sterilizer is provided with a glass gauge to show the quantity of cumol in the cylinder, and a thermometer registers the temperature of the fluid; there is an attachment for a hose to carry off the vapor as it is generated. The sand between the cylinders is heated by a Bunsen gas burner, which stands on the tray; a uniform heat is easily generated, raising the temperature of the cumol quickly to 165° C. (330° F.), necessary for the sterilization.

An admirable method of sterilizing and storing catgut is that of Dr. Willard Bartlett, of St. Louis, Mo., which has been extensively tried, with entire success, by the brothers Mayo, of Rochester, Minn. Dr. Bartlett describes the process as follows ("A Simple Method of Sterilizing and Storing Catgut—Preliminary Report," *Interst. Med. Jour.*, 1905, vol. xii, No. 3):

1. The strands are cut into convenient lengths, say 30 inches, and made into little coils about as large as a silver quarter of a dollar. These coils in any desired number are then strung like beads onto a thread, so that the whole quantity can be conveniently handled by simply grasping the thread.

2. The string of catgut coils is dried for one hour at a temperature of 180° F., and then for a second hour at 220° F., the change in temperature being gradually accomplished.

3. The catgut is placed in liquid albolene, where it is allowed to remain until perfectly "clear," in the sense that the term is used in the preparation

of histological specimens. This is usually accomplished in a few hours, though it has been my custom to allow the gut to remain in the oil over night.

4. The vessel containing the oil is placed upon a sand bath and the temperature raised during one hour to 320° F., which temperature is maintained for a second hour.

5. By seizing the thread with a sterile forceps the catgut is lifted out of the oil and placed in a mixture of iodine crystals, one part, and Columbian spirits (deodorized methyl alcohol), one hundred parts. In this fluid it is stored permantly, and is ready for use in twenty-four hours; the thread is then cut and withdrawn.

Gauze, or cheese cloth, is used in large quantities during operations and for the dressings afterward, and it is bought to advantage in bales of one hundred yards each. It forms the best covering for parts of the body around the field of operation, and is a good absorbent and protective when laid as a dressing, six to eight folds thick, on wounds. It is also valuable for making pads to be used in the abdomen during an operation, and for small gauze sponges.

Absorbent cotton, which is common cotton cleansed and deprived of its oil in order to render it absorbent, is the most efficient dressing we possess for taking up discharges, whether applied to the vulva or over an abdominal wound, either directly or on top of a gauze pad. It is also used in padding the inequalities of the abdomen after an abdominal operation before applying a bandage.

Cotton bolsters covered with gauze are needed to hold back the obtruding coils of intestines in abdominal operations. They are made of non-absorbent cotton, which does not take up moisture, and so preserves its elasticity. The cotton is prepared in rolls 4 to 6 cm. (1½ to 2½ inches) in diameter, which are then cut in lengths of 12 cm. (5 inches) and covered with gauze.

Gauze, cotton, towels, and bandages must be sterilized fractionally by placing them in the steam sterilizer for an hour, then taking them out and again sterilizing them for half an hour at a time on two successive days. After sterilization they should be preserved in large glass jars. It is easier to take what is wanted from the stock without contaminating the rest if, instead of keeping it in bulk, it is broken up into smaller packages before sterilization and rolled in towels or gauze. These small rolls should be kept unopened until needed. When called for, the nurse lifts one of the rolls from the jar, and, unpinning it without touching its contents, lets the ends fall back and holds it to the operator or dresser, who then takes what he wants. Dressings sterilized for immediate use may be used with perfect safety, the fractional sterilization being necessary only when they are to be stored for future use.

Where enormous quantities of gauze are used the expense may be diminished one half by sterilizing and using it over again, as suggested by Dr. J. C. Bloodgood, of the Johns Hopkins Hospital, where the gauze, after using it once, unless the case is known to have been a streptococcus infection, is washed out in cold water and then soaked in a strong solution of carbonate of soda to cleanse and remove the blood; it is then taken to the laundry, boiled and dried, and sent back. The patients now smooth it out and roll it up, after which it is sterilized in a steam sterilizer for a half an hour, and used in the ward for various dressings. But a layer of new gauze is always put next to a recent wound.

Iodoform gauze is prepared with aseptic hands by rolling plain sterilized gauze in 3-meter (about 3 yard) lengths, and then cutting up the roll into different lengths and breadths to meet the various requirements.

Before dividing the large roll into these smaller pieces it is saturated with the following iodoform mixture: To 180 c.c. (6 ounces) of warm water, made into a good suds with Castile soap, add 45 c.c. (an ounce and a half) of powdered iodoform, and mix it well in a clean basin with a glass rod. Then immerse the roll of gauze in the liquid, and work it with the hands until the iodoform has been completely taken up into the meshes of the roll. This is now sterilized three times in the steam sterilizer.

Sponges.—Sponges are difficult to sterilize, and for this reason were for some time largely abandoned, but at present they are again used freely in abdominal surgery. No substitute possesses the same degree of elasticity and absorptive power; but the responsibility of sterilizing sponges is so great that it must never be left to druggists or instrument makers.

Steps in the preparation of sponges.

1. Lay them in a stout cloth and pound sufficiently to break up grit and lime.
2. Rinse with warm water ten or more times until it remains clear.
3. Immerse in a muriatic acid solution, 15 c.c. to 1 liter (ʒij to Oj), for twenty-four hours.
4. Immerse in a saturated warm solution of permanganate of potassium.
5. Decolorize in a hot saturated oxalic acid solution.
6. Pass through limewater to take out all the oxalic acid.
7. Rinse thoroughly in plain sterilized water.
8. Immerse in a 1–1,000 solution of bichloride of mercury for twenty-four hours.
9. Preserve, until used, in a 3 per cent carbolic acid solution.

The hands manipulating the sponges during these preparations, from step four on, must be sterile, and much of the manipulation may be done with instruments.

When wanted for use, the sponges are lifted out with a long pair of sterilized forceps, and rinsed in sterilized water. I never use the same sponge twice, although this may be safely done after aseptic operations.

The best substitute for a sponge is Berlin wool made into a small ball and covered with gauze, which can be sterilized in the ordinary way in the steam sterilizer. Another good substitute for sponges is small gauze mops, made by cutting gauze into convenient strips and rolling these into small balls; a sufficient quantity of these sponges can be prepared before operation by the nurse, stored in linen bags, and sterilized by the fractional method.

In operations in private houses, where the water supply is questionable, the so-called dry technique, in which dry gauze and sponges are used instead of water, is decidedly safer.

Rubber drainage pads are especially valuable in permitting an abundant use of water without wetting the patient's clothes or the floor. The largest size, devised for drainage in ovariotomy and abdominal surgery in general, is a circular sheet of rubber 62 cm. (25 inches) in diameter, with a rim 10 cm. (4 inches) in diameter, which is inflated when in use. An apron 61 cm. (24 inches) long, extending over the edge of the table down into a bucket, carries away the waste. The patient rests with her buttocks at about the center of the cushion, and her clothes drawn well above it; all water poured on the abdomen runs over the sides or between the thighs down on to the rubber, where it is diverted by the inflated rim toward the apron, and so carried over the edge of the table into the bucket.

A rectangular perineal pad is needed in vaginal operations, facilitating the abundant use of water by protecting the back and sides, and diverting the water by its inflated rim and apron over the side of the table into a receptacle. Its measurements are: Width, 34 cm. (14 inches); length of apron, 54 cm. (22 inches); and size of inflated rim, 9 cm. (4 inches).

These pads are cleansed by scrubbing after each operation with soap and water. If they are discolored, they are sponged off with a saturated oxalic acid solution. If infected, they may be rinsed with a 1–500 bichloride solution and hung in a sunny place to dry.

Vessels.—Glass, hard-rubber, porcelain-lined, or agate-ware vessels hold the instruments, immersed in hot water, during the operation. The smooth, hard surface does not readily lodge septic material, and is easily cleansed after an operation. Rubber trays are useful in private practice, on account of lightness in transportation, and the fact that a number can be nested without chipping. Glass vessels, although so perfectly in harmony with their surroundings in appearance, and so desirable on account of their transparency, which reveals at once the slightest spot, ought to be given up because their fragility makes it impossible to subject them to the rigid requirements of steam sterilization without constant losses from breakage. Pure white porcelain-lined vessels must be used in place of glass.

In clinics where the steam sterilizer is sufficiently large, the best way to sterilize the dishes is to put them in the steam bath along with the dressings.

PREPARATION OF THE OPERATOR, ASSISTANTS, AND NURSES.

Personal cleanliness must be observed by frequent bathing, changes of underclothing and of linen, and by wearing clean, well-brushed clothes. A man who is dirty in his general habits is unfit to practice surgery. The obligation to keep clean begins long before entering the operating room for the purpose of "washing up"; it is a duty devolving upon surgeon, assistants, and nurses, at all times, to avoid direct contact with septic materials whenever it is possible, and to scrub the hands thoroughly and, in many cases, to sterilize them carefully immediately after any such contact. Both surgeon and assistants should acquire a feeling of instinctive aversion to touching anything septic.

Septic cases must be relegated to the end of the operating list. On concluding a septic operation the conscientious operator will at once think of his next work, though it may be several days off, and he will immediately proceed, while his hands are still moist, to secure a thorough mechanical disinfection with soap and water. He will also do well to repeat this several times in the interval, at home or in the clinic.

The preparation for an operation begins, therefore, at the preceding operation; it may be days beforehand.

An assistant whose ward work brings him into direct contact with abscesses and sloughing carcinomatous cases, and, above all, one who has charge of, or has examined a case of puerperal fever, must be debarred from helping at operations.

Operating Suit.—Preparatory to operation, the coat, vest, shirt, and trousers must be removed and a sterilized linen suit put on; the jacket is made with short sleeves, for the upper arm only, and buttoned up the back; the trousers, if made of a separate piece, have a draw-string at the waist, and are made without buttons or buckles. A sterilized linen cap and white canvas shoes complete a costume fulfilling the requirements of an aseptic technique. Just before each operation the nurse takes a sterilized gown out of her stock of supplies and puts it on the operator, covering his arms, body, and legs down to the floor. After this, rubber gloves must be put on and the mouth must be covered with a napkin of from six to eight pieces of gauze tied with four tapes on top of the head and behind the neck.

Brushes.—The brushes for scrubbing the hands and nails must be made of stiff bristles, or, better, of a vegetable fiber, such as the Mexican Tampico grass, of durable quality; they are sterilized after every use in the steam sterilizer, and kept in a wire basket. The brush should have a strong wooden back, to afford a good grasp, and should not measure less than 12 by 4.5 cm. The fiber brushes stand repeated sterilizations. As soon as the fiber gets soft

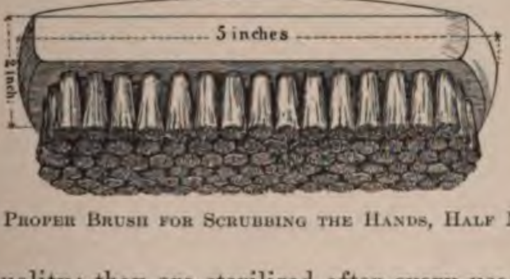

FIG. 12.—THE PROPER BRUSH FOR SCRUBBING THE HANDS, HALF NATURAL SIZE.

the brush must be thrown away. The same brush must never be used by two different persons, or twice by the same person without resterilization.

As I visit various clinics, I often see no more serious defect in their technique than the miserable, insignificant, flabby nail brushes, sometimes used by the surgeon and all his assistants in common, without any, or with at most but one sterilization. Scrubbing the hands, and particularly the nails, with such brushes becomes a farce.

Disinfection of Hands and Forearms.—The first duty of the operator, assistants, and nurses upon entering the operating room is to remove from hands and forearms all contamination from the thousand contacts of daily life, as well as to destroy those germs which have their habitat in the superficial parts of the skin and under the nails.

The nails should be kept short to facilitate cleansing the subungual spaces. The physician no longer feels a pride, as in the old days, referred to by H. R. Storer (*Amer. Jour. Obst.*, 1869, vol. i, p. 122), when he says: "I am aware that many accoucheurs pride themselves on a nail that would do credit to a Chinese mandarin, upon the ground that it is useful for the purpose of scratching through an unusually tough bag of fetal membranes that may not have easily ruptured, or for artificially detaching a detained or adherent placenta." The free margin of the nail should be left about 1 mm. in length; the best time for performing this little toilet operation is at home, while the nails are soft after the morning ablutions. It is always offensive to the sense of cleanliness to see a surgeon clipping his nails in the sterilizing or operating room, and letting the cuttings fall to the floor.

Many methods of hand disinfection have been proposed. Among these, Fürbringer's is perhaps the most commonly known and generally used. To carry out this method the hands are scrubbed for a minute with soap and water as hot as can be borne; they are then rubbed for a minute with 80 per cent alcohol, and finally washed with a 0.5 per cent sublimate solution.

This method yields fair results, but it is not absolutely certain, as shown by my own experiments; for even after the most careful use of the procedure, if the mercury is precipitated by a sulphide of ammonium solution, cultures can often be obtained from the scrapings from the skin and subungual spaces.

Welch says in this connection: "It may be urged that it is not necessary actually to kill the bacteria upon the skin; it is sufficient if they are rendered incapable of growth; and as most of those which are not killed by the sublimate do not grow upon our ordinary nutrient media, it is reasonable to infer that they will not grow upon wounds. This line of argument certainly deserves consideration. Nevertheless, there is no positive proof that these bacteria will not grow in wounds under some conditions, and surely we shall feel safer with a method of disinfection which actually kills the bacteria."

I adopted, in 1889, the permanganate of potassium and oxalic acid method of disinfection of hands, which had been used by Prof. F. Schatz, of Rostock, for the purpose of prolonging the act of washing the hands for greater security, but not with any germicidal intent. In 1891 my assistants, Drs. Robb and Ghriskey, carried out a series of bacteriological experiments to test the efficacy of this method, and these were embodied in an article written for the *American Journal of Obstetrics,* vol. xxiv.

From these studies I arrived at the following conclusions, which have stood the test of time:

1. Staphylococci are present on the hands of all persons.
2. It is impossible to get rid of these organisms even by scrubbing the hands and nails from ten to twenty-five minutes with a sterilized brush, soap, and water at a temperature of 40° C.
3. The bichloride of mercury solutions as used, up to 1 to 500, are not germicidal as supposed, but they are inhibitory, as demonstrated by cultures growing after the precipitation of the bichloride with ammonium sulphide (Geppert).

At the time these experiments were conducted it was believed that the permanganate of potassium was the active germicidal agent, the oxalic acid being used simply to neutralize and decolorize the permanganate of potassium.

A series of experiments by Dr. Mary Sherwood, conducted in 1893 at my request, to determine the relative part played by these two chemicals in the process of disinfection, led, however, to the conclusion that both the permanganate of potassium and oxalic acid were germicides, but that the oxalic acid, at a temperature of about 40° C., is a much more powerful germicide than permanganate of potassium. (See *Johns Hopkins Hospital Reports,* vol. iii, p. 359.)

The strong evidence furnished by these two series of experiments regarding the efficacy of the permanganate and oxalic acid as disinfectants is further sustained by an extended practical experience.

In my clinic the cleansing and disinfection of the hands and forearms is accomplished in four steps:

1. The hands and forearms are first vigorously scrubbed for ten minutes with a brush, using common, brown kitchen soap or green soap and hot water. Particular attention must be given to scrubbing the surfaces between the fingers, and to the nails, which must not be more than 1 mm. in length. The most vigorous efforts in washing must be devoted to the spaces beneath and about the nails. The water should be as warm as can be comfortably borne, and either constantly changed with fresh water running in, or poured out and changed completely four or five times. The duration of this important step must not be measured by guessing; a clock must stand directly over the wash-basins, and assistants and nurses for the first three months should be required to spend never less than fifteen minutes in cleansing their hands. After the experience in washing thus gained, the time may be reduced to ten minutes. Although the hands and arms now appear clean, they are not aseptic,

for cultures taken from beneath the nails and from the skin will develop colonies of micrococci, often in large number, and in spite of any washing, however prolonged and thorough.

2. The hands, thus mechanically cleaned and softened, are next immersed in a hot saturated solution of permanganate of potassium until stained a deep mahogany color.

3. They are then immersed at once in a saturated solution of oxalic acid, which decolorizes and completely sterilizes them. The oxalic acid solution should be as warm as can conveniently be borne.

4. The oxalic acid may be removed by rinsing the hands in warm water, but it is better for this purpose to keep on hand a dish of sterilized limewater, which at once precipitates the oxalate of lime.

One of the most satisfactory methods of cleansing the hands is the use of nascent chlorine, as recommended by R. Weir (*Med. Rec.,* April 3, 1897, p. 47). After scrubbing the hands with warm water and soap, the surgeon takes up a few crystals of carbonate of soda (washing soda) and, dissolving them with a little warm water, rubs them well over his hands and arms. He next takes a small spoonful of the chlorate of lime and distributes this actively over hands and forearms already covered with the soda solution. As the chlorine is thus generated out of the pasty substance formed by the mixture, the chemical action produces a decided feeling of warmth and an odor which, to a sanitarian, carries with it pleasant suggestions of cleanliness. After the hands and arms have been thoroughly rubbed and brushed for from three to five minutes with this species of chlorine soap, particular attention being paid to the nails, the mixture is washed off with warm water, after which the rubber gloves may be put on.

Ahlfeld's method of sterilizing the hands (*Deutsch. med. Wochenschr.,* 1897, No. 8) is a very simple one. After cutting the nails and duly cleansing the subungual spaces, the hands are washed for five minutes with hot water and soap, rinsed in clean water, and then brushed with pure alcohol. This operation is followed by a thorough rubbing with flannel.

The advantages of alcohol used in this way, as shown by experiments by Ahlfeld, Reinicke, Poten, Fürbringer, and Freyham, are: (1) It exercises bactericidal properties; (2) it dissolves fatty substances, and by its union with water, it not only enters deeply itself, but opens the way for more thorough penetration of sublimate or any other disinfectant subsequently applied; (3) it loosens the superficial epidermis with the attached dirt and bacteria, and carries it off.

Fürbringer's method of disinfecting the hands is similar to that of Ahlfeld. It consists in:

1. Thorough cleansing of the nails and washing the hands with soap and water and a brush.

2. Washing for a minute in alcohol not below 80 per cent (Gottstein recommends alcohol between 50 and 70 per cent).

3. Thorough rubbing of the hands in a 3 per cent solution of carbolic acid, or a 1 to 2 *pro mille* solution of corrosive sublimate.

After such a thorough preliminary disinfection it will still be necessary to return to the wash-basins frequently during the preliminary preparations and during the operation to remove the contamination of various necessary contacts with substances not sterilized—such as the body of the patient, the outer surfaces of dishes, lids, etc.

By turning again to the wash-basins and vigorously scrubbing for thirty seconds or more with a fresh sterilized brush, the superficial contamination is removed.

Pads of sterilized gauze 15 cm. (6 inches) square are useful in enabling assistants and nurses to touch handles and lids of jars, etc., without contamination.

With the completion of these antiseptic preparations the operator and his assistants are in a position to go on with their work under the new antiseptic régime; for the efficient employment of antisepsis before the operation has secured a condition of asepsis which it will henceforth be the constant effort of surgeon, assistants, and nurses to maintain throughout and after the operation.

Although the methods just detailed are indispensable in the preparations for an operation, it is still more important that the surgeon, assistants, and nurses should live under such a keen realization of the vital relations of sepsis, antisepsis, and asepsis to their work that they shall always feel an instinctive repugnance to contact with any septic material. This sensibility must be especially alert in relation to intestinal and vaginal examinations, treating abscesses, handling sloughs, or touching pathological matter at autopsies, etc. The occasions are rare which justify a surgeon in engaging directly in a post-mortem examination or in handling septic specimens at all. After any such necessary exposure the operator should scrub his hands and forearms thoroughly with soap and warm water, and finally sterilize them with the hot saturated permanganate of potassium and oxalic acid solutions.

Surgical assistants and nurses are at all times disqualified by their occupation from taking any part in a post-mortem examination. This instinctive shrinking from infection, keeping always on guard against sepsis, may well be termed "the antiseptic conscience."

Rubber Gloves.—The introduction of rubber gloves for the hands of surgeons and their assistants during operations marks a notable era in the annals of antiseptic surgery. There is, perhaps, no other single feature in our surgical technique which has done so much to reduce both the mortality and the morbidity of grave operations. The practice of wearing gloves while operating is now universal in first-class clinics, and is, therefore, obligatory upon every conscientious surgeon.

The value of the glove is, first, that it protects the wound from the hands of the surgeon, which can never be absolutely sterile; second, that the surgeons and his assistants are protected from contact with any septic material, and therefore they run no risk of transporting germs from one patient to another. For these reasons gloves should always be worn during examinations or the dressing of wounds where there are infectious and suppurating surfaces with which the hands are necessarily brought in contact.

The best gloves are those made of rubber, in three grades, thin, medium, and thick. The thick gloves, which cost about $1.50 a pair, outlast many pairs of thin ones and are equally satisfactory for all ordinary purposes, but where a delicate sense of touch is called for, the thin gloves are more satisfactory. An economical plan is for the operator himself to wear the thin gloves, while the assistants and nurses wear those of thicker texture.

Sterilization of Gloves.—The gloves must be placed in a linen bag, immersed in boiling water, and boiled for five minutes. The boiler must be tightly covered. When the gloves are taken out they should be placed in a dish of bichloride. To keep the gloves sterilized they must be filled with boiling water in order to keep the air out, then dropped into a boiler and boiled five minutes. They should be lifted out with forceps, and after the water is carefully drained off, placed in sterile towels.

It is not generally known, I think, that gloves were first systematically employed in the clinic of W. S. Halsted, at the Johns Hopkins Hospital. Halsted speaks of their use in the *Johns Hopkins Hospital Reports* (1891, vol. ii, p. 308), where, in describing his technique, he states that " the assistant who passes the instruments wears thin rubber gloves, which are disinfected in a corrosive sublimate solution." From the year 1900 on, Halsted has persistently and consistently used these gloves in all his operations. As he writes to me: " From the day that the first pair was worn we have never ceased to employ rubber gloves in my clinic." In my own clinic, which from the very first has owed so much to that of Halsted, gloves were introduced by my assistant, Hunter Robb, who fully describes their use and the methods for their sterilization and preservation in his work on " Aseptic Surgical Technic," 1894, p. 125 (see also *Centralbl. f. Chir.*, 1895, Bd. xxii, p. 741).

Rubber gloves were next recommended by Zoege von Manteuffel in Dorpat (*Centralbl. f. Chir.*, 1897, p. 553); in the same year Mikulicz recommended the use of cotton gloves (*Centralbl. f. Chir., loc. cit.*, p. 713) which perfectly protect the wound from infection through the subungual spaces, and have been shown to be perfectly satisfactory, if changed one or more times during an operation. These gloves are those used by waiters in Germany and known as "*feine Dienerhandschuhe*"; they cost about 68 cents a dozen.

Wölffler (*Beiträge z. kl. Chir.*, 1897, Bd. xix) uses leather military gloves, which have been preserved in 3 per cent carbolized glycerin or 1–5,000 sublimate solution. In abdominal operations the gloves are washed out in a salt solution.

Mouth Protector.—The operator and the assistant who stands opposite to him should always wear protectors over the mouth, consisting of some six to eight folds of gauze, made up into the shape of a little napkin with tapes attached at the four corners, and tied over the top of the head and back of the neck. This simple device serves to protect the patient from infection through little particles of sputum escaping from the mouth during acts of breathing or speaking. Flügge, Miller, Formad, and Hübener have shown how serious is the risk of infection from this source. Mikulicz (*Centralbl. f. Chir.*, 1898, Bd. xxv, Beilag No. 26, p. 9) describes Hübener's face mask devised for this purpose and used in his clinic in Breslau.

CHAPTER II.

ANTISEPSIS AND ASEPSIS IN PRIVATE PRACTICE.

1. Differences between private and hospital surgery (p. 28): Three plans for preparing sterilized kit: In a public hospital. Room prepared in surgeon's own house. By associate in private hospital.
2. Equipment of sterilizing room at surgeon's house (p. 29).
3. Sterilization of instruments, dressings, and ligatures (p. 29).
4. Instrument bags (p. 32): Contents. Plastic operations. Abdominal operations.
5. Preparation of room for operation (p. 34).

DIFFERENCE BETWEEN PRIVATE AND HOSPITAL SURGERY.

Antisepsis and asepsis can be attained and carried out in private practice only with a greater expenditure of time and trouble, in marked contrast to the facilities of the operating room in the modern hospital. With due care, however, and constant painstaking attention to details, a room in a private house may be so prepared that the principles already laid down need not be violated.

The chief difficulties encountered are in thorough sterilization and in the preservation of the instruments and dressings in an aseptic state, together with the proper preparation of vessels, towels, and sheets at the patient's home. The surgeon is sometimes compelled to intrust these matters to unskilled assistants, or, in an emergency, even to the family servants. Another reason why work in private houses is less satisfactory must not be overlooked; it is the embarrassment of the new surroundings to the surgeon himself. The number and disposition of assistants, the source of light, the slight delays on the part of the nurses in attending to their duties, as well as the many minor questions as to the bacteriological condition of this or that article, all contribute to emphasize the difference between routine and emergency work. Not the least distressing feature of surgical work in private practice is the liability to forget important instruments in packing the kit, or the awkwardness of a makeshift when an unexpected need has arisen, which cannot be supplied from the armamentarium at hand.

But, in spite of all the objections which may be raised, a large amount of gynecological work will continue to be done in private houses. Such are the emergency cases which dare not travel, and the patients of surgeons without satisfactory clinical conveniences, or of those whose practice lies largely in country districts, where a repugnance to a hospital still lingers.

In spite of all precautions and preparations, I confess to a feeling of anxiety after important operations in private, which is only relieved when the patient is convalescent. The first difficulty to be met is the need of suitable assistance. Every operator with a large practice must have a trained assistant to help him in his private operations, to care for the instruments, and to make the necessary preliminary preparations for operation at the house of the patient. Such an assistant must be a man with a broad hospital training. The second point of importance is the sterilization of the instruments and dressings. The instruments may be sterilized either before going to the patient's house or upon arriving there; the dressings must always be sterilized beforehand.

My own method has been to sterilize and pack away all instruments and dressings immediately after returning from an operation, so as to be ready for a call at any moment. I keep prepared in this way three bags of instruments and dressings: one, for an ordinary gynecological examination and for dilatation and curettage; another, for plastic operations; and the third, for abdominal surgery.

I have tried three plans in the preparation of an instrument kit: first, to have it prepared by my resident at a public hospital; second, to fit up a sterilizing room in my own house; and, third—my present plan—to place all preparations in the hands of my associate in my private hospital, who supervises the work of the operating-room nurse in putting them in order. The last plan is the most satisfactory, but for the sake of the great number of surgeons who must prepare at home, I describe the

EQUIPMENT OF A STERILIZING ROOM AT THE SURGEON'S HOME.

When possible, a special room should be set apart for this purpose. It need not be larger than 8 by 10 feet—big enough to hold the instrument case and receptacles for dressings, a sterilizer, and a washstand. It should be well lighted, with walls coated with a light enamel paint. If the floor is not close jointed, linoleum or oilcloth, turned up against the washboard at the edges, gives a clean surface, which may be frequently mopped.

A glass instrument case with a metal frame is the best for purposes of cleanliness, but one of hard wood, preferably oak, will answer. The shelves upon which the instruments lie should be of glass or else covered with glass plates.

A steam sterilizer of the Arnold pattern occupies one corner of the room, with a large Bunsen burner beneath it. A sink, 2 by 4 feet, supplied with hot and cold water, is an important, but not an essential convenience.

A wooden table with a glass or paraffined top, a bench, glass jars for dressings, sponges, and ligatures, 3 enameled basins, 1 enameled dipper of a liter capacity, 2 agate-ware reservoirs holding 5 gallons each, and a large shallow boiler on a gas-burner for the instruments, complete the furniture of the room.

STERILIZATION OF INSTRUMENTS, DRESSINGS, AND LIGATURES.

A large quantity of sterilized dressings, sponges, and ligatures ought always to be ready, so that they may be taken out of the supply jars at a moment's notice, without waiting to sterilize more; but the dressings should not be kept over a month without resterilization.

The instruments must be sterilized immediately after returning from an operation. To do this, they are first scrubbed with a brush with soap and warm water, especial care being taken to remove all visible traces of dirt from joints and corrugations. They are then wrapped in a towel, put on a rack in the long shallow boiler, and boiled for five minutes in a one per cent solution of carbonate of soda. The knives must be wrapped separately in absorbent cotton to protect the edges.

Before beginning the preparations, the floor is mopped up and the table and chairs washed off with hot water and soap to remove the dust. All the agate-ware vessels are scrubbed with soap and water and scalded out with boiling water; the two large reservoirs are filled two-thirds full of water boiled for half an hour, and one of them set aside to cool. A half liter of a saturated solution of oxalic acid and a half liter of a saturated potassium permanganate solution are prepared in two of the agate basins, while a third basin is left for the hands.

The hands are now scrubbed and disinfected by the permanganate of potassium and oxalic acid solution, as described in Chapter I; or a pair of sterilized rubber gloves may be worn, and the thorough sterilization of the hands left until all the preparations have been made. The instruments are lifted out of the boiler and rinsed with plain boiling water, taken with a sterilized cup from the agate-ware reservoir. They are laid on one of the sterilized towels and at once wiped perfectly dry with another towel. If the water used is hot, they will dry much more rapidly. They are next assorted, the knives put in a special sterilized metal box by themselves, and placed in a sterilized bag of butcher's linen. Sterilized instruments thus put away in a bag and stored in the kit will remain sterile until the bag is again opened.

Dressings, ligatures, and sponges are best sterilized in bulk beforehand, when the following preparations are necessary:

Silk and silkworm gut are cut the desired lengths, placed in stout ignition tubes plugged with cotton, and put in a wire basket. A dozen assorted needles are threaded with carriers and stuck in a large gauze pad, like a needle-book, so as to be rolled up.

Towels are made up into bundles of two sizes, one containing 6 and the other 8 towels, and inclosed in a linen bag.

Cotton is cut in strips 30 cm. (12 inches) in length, made up into convenient-sized packages, and rolled in towels securely pinned.

The gauze is doubled and cut in pieces one meter (40 inches) square, and one half meter (20 inches) square, and into pads 15 by 20 cm. (6 by 8 inches) in size and several folds thick. The large sizes are used to cover the abdomen in abdominal operations, and to cover the buttocks in vaginal operations; the medium sizes to lay in the abdominal cavity over the intestines during an operation; and the smaller pieces to protect the hands in grasping contaminated objects, such as cautery handles, etc. For abdominal cases four large, four medium, and four small pieces should be put up into one package, while for plastic cases only two of the large and two of the small pieces are required. Each package should be wrapped in a towel, and then inclosed in an outer protector and sterilized. This enables the assistant to open the covering before sterilizing his hands, and so does away with the necessity of having some one else open the packages for him later on, after his hands are sterilized. Protective stockings for perineal operations and T and abdominal bandages are laid in bags to be sterilized. Every bag before sterilization must bear a label stating its contents; this may be done by writing on the bag in large letters with indelible ink. When these packages are all ready they are put, loosely packed, together with the wire basket full of ignition tubes, into the sterilizer and steamed for one hour. Dressings thus sterilized only once should not be used except in cases of emergency; if there is time for deliberate preparation, the fractional method must be followed by sterilizing for half an hour upon each of the following two days. While the dressings are being sterilized, the glass jars in which they are to be stored must be thoroughly washed with soap and water, and rinsed out with a 1–500 bichloride solution, followed by warm sterilized water. After the first sterilization the wire basket containing the ligatures is lifted out and set aside for use. The dressings, protected by a towel, are left to dry in the sterilizer with the top off.

The ignition tubes containing ligatures are now marked with a label stating the size of the ligatures and the date of sterilization, after which they are stored away in glass jars, ready for use at any time, safe from the invasion of micro-organisms, which will not penetrate the cotton plugs or the linen envelopes. The linen bags are made up, in various sizes, of heavy butcher's linen, closed with a draw-string. The bag should be enough longer than the instruments for the top to fold well over before tying. I use bags of the following dimensions: The larger size, 38 by 20 cm. (15 by 8 inches), for instruments and dressings; the smaller sizes, 30 by 15 cm. (11 by 6 inches), and 12 by 8 cm. (5 by 3 inches), for the rubber tubing, needles, etc.

Rubber cloths and pads should be disinfected by scrubbing with soap and water, rinsing with boiling water, and finally, sponging with a 1–1,000 bichloride of mercury solution; this is washed off, after which they are dried in the sunlight and inclosed in linen bags. The agate instrument trays should be rinsed with boiling water and set aside, filled with a 1–1,000 solution of bichloride, for an hour; they are then rinsed off and inclosed in linen bags. From 50 to 100 sponges should be sterilized at one time, according to the method described in the preceding chapter. They are preserved in a carbolic acid solution (3 per cent), which must be changed at least once in ten days. All the dressings, instruments, sponges, and accessories having been prepared, the operating bag may be packed.

INSTRUMENT BAGS.

Canvas telescopic bags make a satisfactory operating kit. The most useful sizes are 38 by 21 cm. (15 by 8 inches), 60 by 30 cm. (24 by 12 inches), and 56 by 30 cm. (22 by 12 inches). The largest size is for the abdominal instruments and accessories, the intermediate for plastic operations, and the smallest for making examinations, removal of sutures, dilatation and curettage.

To pack the bag, a sterilized linen cloth is first laid in it, hanging well out over the edges; then the instruments are put in, and finally, a complete list, distinctly written on a card, is placed conspicuously on the inside cover. By consulting this list at any subsequent time, the surgeon knows at once what articles the bag contains without opening the packages, and can add any special instruments needed for particular cases. As the nurse packs the kit, she keeps the appropriate list for plastic or abdominal operations, before her, checking the articles as they are put in. The glass must be stored in the center to prevent breakage. When the bag is full a towel is laid over its contents, and the linen cover is brought together and pinned over all. The instruments to be taken in plastic cases will be found enumerated in Chapter VI.

ARTICLES FOR ABDOMINAL BAG.

For Operator, Two Assistants, and Anesthetizer.

Doctors' canvas shoes (3 pair).
Doctors' canvas coat (1).
Doctors' basket-cloth suits (3).
Doctors' basket-cloth aprons (3).
Doctors' basket-cloth caps (3).

Ether cone and sponge.
Ether cans (8).
Can opener.
Chloroform and inhaler.
Nitrous oxide gas apparatus.

Fiber hand scrubbing brushes (4).
Soap.
Green soap.
Permanganate of potassium.
Oxalic acid.
Bichloride tablets.
Rubber gloves (4 pair).
Kelly pad.
Scrub balls (4).
Green-soap tincture.

Razor.
Catheters.
Tube for specimen of urine.
Formalin (10 per cent), for pathological specimen.
Vaseline.
Mouth covers.
Towels (4 packages, 6 to 8 in each).
Gauze sponges.
Abdominal sheet, open in center.
Abdominal pads.
Sponge dishes (2).
Instrument dishes (2).

Knives (2).
Thumb forceps, short (2).
Thumb forceps, long, curved (2).
Clamps, short, curved (12).
Clamps, long, curved (12).
Clamps, straight (12).
Sponge holders (2).
Needle holders (one long and one short).
Needles, assorted sizes (12).
Intestinal needles.
Uterine sound.
Abdominal retractors (3).
Long-toothed retractor (1).
Tenaculum forceps (2).
Kelly's Museux forceps (3 pair).
Gauze packer.
Spud, or curved knife, for hysterectomy.
Scissors (blunt and pointed).
Trocar and tubing.
Appendix clamp.
Paquelin cautery.
Douche nozzle.
Long irrigation point, for flushing abdomen.
Douche bag.
Perineal pads.
Mackintosh.

Silk ligatures, Nos. 3 and 4.
Catgut ligatures, Nos. 1, 2, 3, 4.
Black silk ligatures, fine intestinal.
Silkworm gut ligatures.

Iodoform drains.
Plain drains.
Rubber drains.
Sulphate of iron.
Silver foil, for wound.
Abdominal gauze dressing.
Adhesive plaster.
Scultetus bandage.
Safety-pins.

Platinum needles, for cultures.
Culture tubes.
Alcohol lamp.
Infusion apparatus.
Ethyl chloride.
Salt tablets, for solution.
Minim glass, for making solutions.
Sodium carbonate, for sterilizing instruments.
Rectal tube and funnel.
Hypodermic syringe.
Morphin.
Strychnin.
Digitalin.
Atropin.
Brandy.
Pure carbolic acid.

To these may be added the instruments required in perineal operations and in dilatation and curettage, if desired.

If the operation is to be an abdominal one, it is essential to send with the kit a portable Trendelenburg table. One of the best I know of, is that of Dr. G. I. McKelway, of Philadelphia, made with a light wooden frame and impermeable cover, weighing altogether 18 pounds, which is clamped on an ordinary kitchen table when used. Dr. G. M. Edebohls, of New York, has devised a beautiful light metal table, swinging on its support at any angle desired; it weighs 36 pounds in its case, ready for shipping, and 34 pounds without the case.

PREPARATION OF THE ROOM FOR OPERATION.

When possible, the surgeon, or his assistant, or a trained nurse, should go to the house of the patient the day before the operation to select a suitable room and to give directions how to prepare it, getting ready towels, bed-linen, water, and vessels. It is my custom to forward these directions:

"Arrange, if you can, a room on the second floor, with good light and ventilation. Remove carpets, curtains, upholstery, and any unnecessary articles of furniture, such as sofas, rocking chairs, fancy tables, brackets, pictures, etc. Have the mattress thoroughly aired, the bed cleaned, and made up with a fresh draw sheet with a rubber sheet beneath. I prefer a single bed. Scrub the floor thoroughly, wipe off the walls, and particularly tops of doors and windows, removing every particle of dust, and on the morning of operation go over all again with a wet cloth. Do not use a dry duster in the room.

"Provide these articles: 4 chairs with wood or cane seats; a table 4 feet long, 2 feet wide, and 30 inches high (common kitchen table); 2 small square tables (I can use a bureau or marble-top washstand, if necessary); 2 clean buckets, a foot-bath tub, 3 basins, a dozen clean towels (not new), 2 sheets, 2 blankets, a new wash boiler, 8 bottles with corks for hot water, 2 pounds of absorbent cotton, a rubber sheet, and a bedpan."

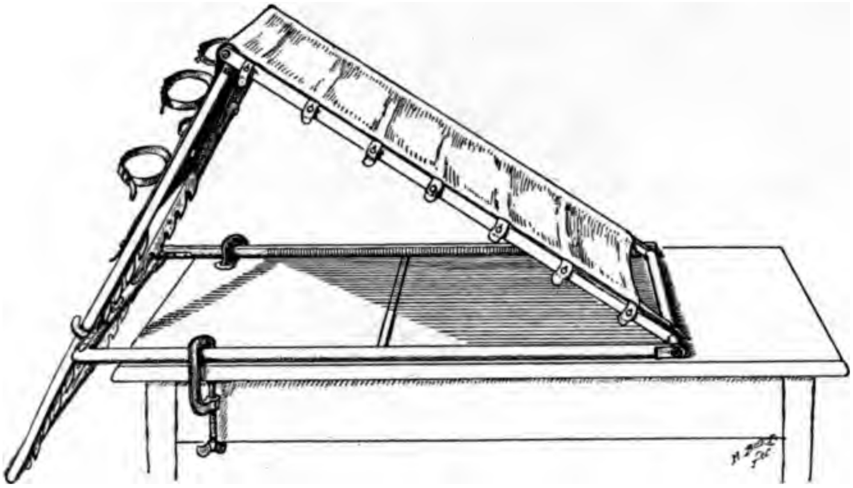

FIG. 13.—McKELWAY'S PORTABLE FRAME FOR ELEVATION OF THE PELVIS.

The frame is made of tough wood, with a water-proof support for the body buttoned fast to it. It is kept in position by a simple ratchet, and it can be attached to any ordinary table by two clamps.

I often add to the list a small tin sterilizer and a gas stove.

The wash boiler must be thoroughly scrubbed and rinsed with boiling water on the morning of the operation, filled with water, distilled if obtainable, put on to boil for an hour, and set aside on the stove, well covered, being kept at about 50° C. (122° F.) when desired for use. When needed it is carried into the operating room. Wash-basins must be scrubbed with soap and water, scalded, and turned upside down on clean towels, so as not to catch the dust of the room.

When the surgeon arrives he should see for himself that his instructions have been fully carried out.

If it has been impossible to give full instructions beforehand regarding the selection and preparation of the room, the assistants and nurse must go to work at once on their arrival, and do the best they can under the circumstances in the time at their disposal. It is better not to take up the carpets on the morning of an operation, but unnecessary furniture should be removed, and a drugget or dampened sheet spread on the floor.

To the operating table is clamped the portable Trendelenburg table, covered with a folded blanket, protected by a sheet. A chair is placed at the end of the table, covered with a blanket and sheet, to serve as a rest for the patient's feet during a celiotomy.

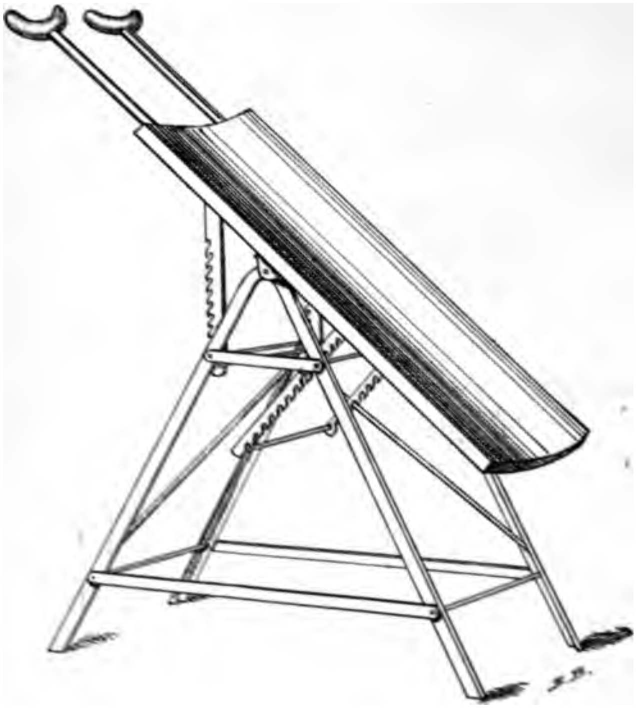

FIG. 14.—EDEBOHLS' LIGHT PORTABLE TABLE.

The table weighs 34 pounds without the case, and 36 pounds cased. It holds the heaviest patients without rocking, and is easily changed to any degree of elevation.

The ovariotomy pad is placed on the table so that the patient's buttocks will lie squarely upon it, while its apron hangs over the edge, on the operator's side, into the foot-bath or bucket. Two smaller tables are covered with sterilized towels, and are used by the assistants; upon one of them the dressings are placed, and upon the other the instruments, still in the bags.

The oxalic acid and permanganate of potassium solutions are now prepared in two basins, and two other basins for the hands are filled, one with a bichloride solution (1 1,000), the other with pure warm water, and placed on the chairs. The basin of bichloride must stand farthest from the operator, in order that he may be less likely to put his hands into it unintentionally during the operation.

The nail brushes, resting in the gauze in which they were wrapped, and the soap are laid by the basins. The rubber bag is filled with warm water and hung about three feet above the table. Basins for sponges and gauze are filled with boiled water, and the razor, soap, and solutions for cleansing the abdomen or perineum laid on a towel within easy reach.

The assistant now sterilizes his hands and forearms, scrubbing them with soap and water and disinfecting them with the permanganate and oxalic acid solutions, as described in Chapter I, following whatever rules as to touching unsterilized objects are in force in the operating room at the hospital. When packages are to be opened, articles to be picked up, etc., the nurse must be called upon to do it.

The instruments are arranged in one of the trays, and preferably covered with boiled water, although some surgeons like to use them dry. The needles, threaded with carriers, together with the suture materials, are placed in another tray. Antiseptic chemical solutions poured on the instruments and ligatures only injure them, and are dangerous to the patient, without helping the technique.

Three free sponges and four sponges on holders, in a basin near by, are sufficient for the average abdominal operation. With instruments and sponges arranged, the assistant turns his attention to the dressings, which are ready to be opened and handed to him by the nurse.

A sterilized bag of gauze sponges should be carried, so that in case it is impossible to obtain water which is unquestionably safe, the dry gauze may be used instead of the regular sponges.

When all these arrangements are completed, the assistant makes a final examination, inspecting the preparations and noting where the various articles required during the operation are to be found.

The patient, who has been anesthetized in the adjoining room, is now carried in and placed on the table. In helping to arrange the patient, shaving and washing the abdomen, the assistant puts on the sterilized rubber gloves, which perfectly protect his sterilized hands from contamination during the various manipulations.

As soon as these preparations are completed the nurse draws the gloves off his hands, when he puts on a fresh pair, and proceeds to arrange the sterilized towels and gauze about the field of operation, and then takes his place opposite the operator.

A slit is made in the gauze sheet over the site of the incision, and the operator, who has also disinfected his hands, begins his work.

The small pads of sterilized gauze must always be used to protect the hands in taking hold of anything not sterilized, such as a cautery handle, a basin, or a pitcher.

The surgeon and his assistants must constantly be on the watch to see, not only that they themselves commit no errors in technique, but also that the nurses, who are more easily embarrassed by their new surroundings, do not infringe on these rules as the operation progresses.

The after-care of the patient will prove easy or difficult, according as her surroundings have been altered to the simple arrangement of a hospital room. Plain, bare furnishings will also materially relieve the nurse in maintaining strict cleanliness. The high, narrow hospital bed is convenient, because it facilitates dressing the wound and feeding and caring for the patient.

A small sterilizer on an alcohol or gas lamp, or even the kitchen range, will serve to sterilize the cotton, bandages, towels, and the instruments used in removings dressings each time just before use, so that this part of the technique need in no respect be inferior to that of the hospital.

CHAPTER III.

BACTERIOLOGY.

1. Micro-organisms normal to the perineum (p. 38): Micrococcus aureus. Micrococcu Micrococcus epidermidis albus. Bacillus pyocyaneus. Pseudo-diphtheria bacilli. coli. Bacillus lactis aërogenes. Bacillus alcaligenes.
2. Bacteriology of external genitalia and of the healthy vagina and endometrium (p. 4
3. Infectious processes of the perineum and external genitalia (p. 42): Pyogenic cocci. I bacillus.
4. Gonorrhea (p. 43): Gonococcus.
5. Tubercculosis (p. 44): Tubercle bacillus.
6. Cystitis (p. 45): Bacillus pyocyaneus. Bacillus coli. Bacillus lactis aërogenes. typhosus.
7. Infections of the internal genitalia (p. 46): Pyogenic staphylococci. Pyogenic strep Bacillus coli. Bacillus aërogenes capsulatus. Diphtheria bacillus. Tetanus ba

MICRO-ORGANISMS NORMAL TO THE PERINEUM.

Under normal conditions the female perineum is covered with bact micro-organisms, several varieties of which find in the superficial lay the skin, in the hair follicles, in the ducts of the sebaceous glands, an in the deeper layers of the corium, the nutritive materials which may f the means for their development. These bacteria live on the intact epid and on the mucous surfaces of the external genitalia, leading a purely phytic existence and doing no harm to the individual. They are derive several sources. Primarily, there are a number of species of Micro or spherical bacteria, which may be found on any portion of the epi and may be considered normal to it. The most important of these are M coccus aureus, Micrococcus albus, and Streptococcus pyog The Micrococcus aureus and albus, or, as they are more generally the Staphylococcus pyogenes aureus and Staphylococcus pyo albus, were first observed in pus by Ogston (*Brit. Med. Jour.*, 1881, p. 369), and were later cultivated by Passett (*Fortschr. d. Med.*, 188 213). Ogston also observed the Streptococcus, which was soon afte vated by Rosenbach and reported in his article ("Mikroorganismen der infections," "Krankheiten des Menschen," Wiesbaden, 1884). These species are commonly called the "pyogenic" or "pus-producing" cocc the frequency with which they are the etiological agents in the product suppurative inflammations. The Staphylococcus is a spherical org arranged in irregular clusters or bunches, while the Streptococcu spherical organism arranged in chains, consisting of from eight to ten to hundred different elements. All the pyogenic cocci are readily cultivated

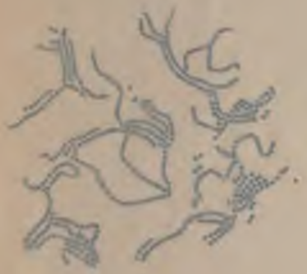

FIG. 1.

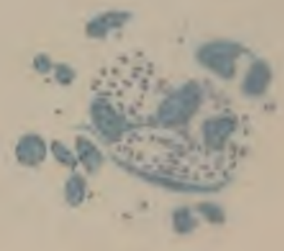

FIG. 2.

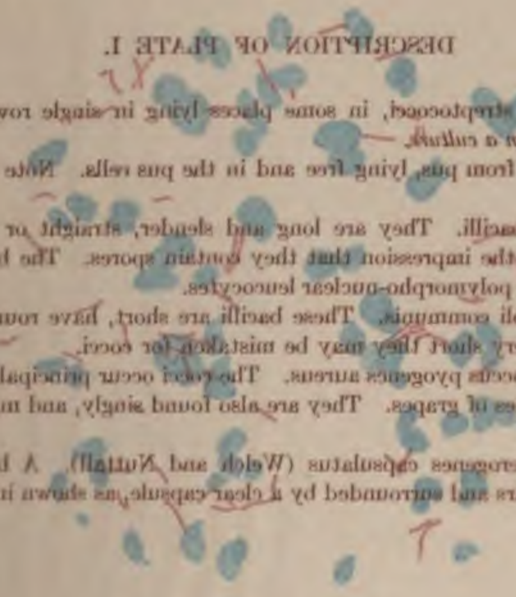

FIG. 3.

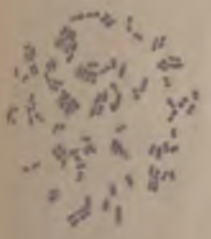

FIG. 4.

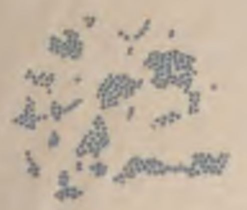

FIG. 5.

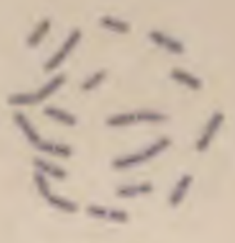

FIG. 6.

[illegible]

H. Becker, fec.

DESCRIPTION OF PLATE I.

Fig. 1.—Chains of streptococci, in some places lying in single rows, in other places grouped in rows. *From a culture.*

Fig. 2.—Gonococci from pus, lying free and in the pus cells. Note their characteristic biscuit shape.

Fig. 3.—Tubercle bacilli. They are long and slender, straight or curved, and stain irregularly, giving one the impression that they contain spores. The blue masses are the nuclei of cells. Chiefly polymorpho-nuclear leucocytes.

Fig. 4.—Bacillus coli communis. These bacilli are short, have rounded ends, and are rather plump; when very short they may be mistaken for cocci.

Fig. 5.—Staphylococcus pyogenes aureus. The cocci occur principally in masses, somewhat resembling bunches of grapes. They are also found singly, and may be seen in short chains.

Fig. 6.—Bacillus aerogenes capsulatus (Welch and Nuttall). A bacillus of variable length, occurring in pairs and surrounded by a clear capsule, as shown in the plate.

PLATE I.

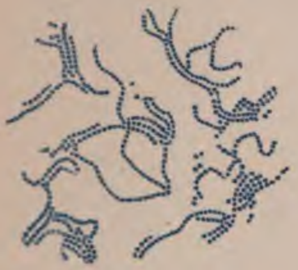

FIG. 1.

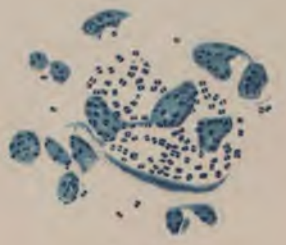

FIG. 2.

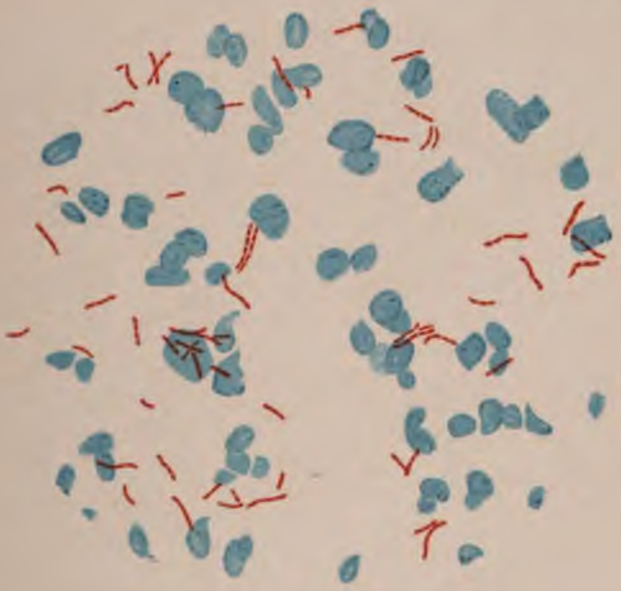

FIG. 3.

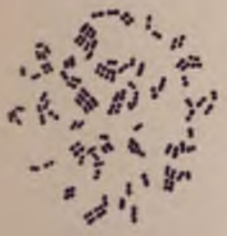

FIG. 4.

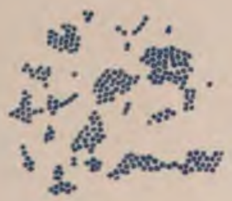

FIG. 5.

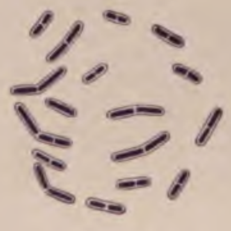

FIG. 6.

×1200

H. Becker, fec.

cteriological laboratory and are identified by quite positive reactions. The aphylococcus aureus, for instance, grows on agar-agar as a thick, moist yer, which gradually assumes a golden-yellow color. It is especially characrized by its rapid curdling of milk with the production of acid, by its lique- ction of gelatin, and by its abundant golden-yellow pigment on potato. he Staphylococcus albus closely resembles the "aureus," but is de- oid of pigment. Both organisms are easily recognized by bacterioscopic ex- mination of pus stained with a good aniline dye, and may be differentiated rom the pus cells by the use of Gram's method, which consists in the application f gentian violet followed by a solution of iodine in potassium iodide. The reparation is then washed in absolute alcohol, when it is found that the yogenic cocci have retained a purple-brown color. They usually lie outside he pus cells, but may be taken up by the latter when these assume the character f phagocytes.

The Streptococcus, on the other hand, needs considerable care in its ultivation in the laboratory. It is a delicately growing organism, which pro- luces only a faint transparent film on agar, while its colonies on this medium re so small as to be easily overlooked unless artificial magnification is used, y means of a low power lens. In the tissues the Streptococcus is charac- erized by its morphological appearance in chains, a picture easily distinguished rom that produced by other micro-organisms or by pus cells. Any of these rganisms may be found on the skin, but that most frequently present is one iscovered by Welch (*Trans. Congr. Amer. Phys. and Surg.*, 1891, vol. ii, p. 1) nd named by him Staphylococcus epidermidis albus. This is a hite coccus, which is almost invariably found in the deeper layers of the orium, and on this account renders absolute sterilization of the skin practi- ally impossible. This organism has the same morphological and staining properties as the pus cocci and is regarded by Welch as an attenuated variety of Staphylococcus albus. It grows with considerable slowness upon artificial media and has little pathogenic power.

Other organisms which may be considered normal to the perineum include several varieties of flagellated bacilli, or rod-shaped forms, and some of the capsulated bacteria. The three most important of the former are Bacillus pyocyaneus, Bacillus coli, and Bacillus alcaligenes.

Bacillus pyocyaneus is so named from its power of producing the so- alled "blue pus" in which it was first observed by Gessard (*Thèse de Paris*, 1882). The color of the pus is due to two pigments, bluish-green in color, which are abundantly produced by the organism, not only in pus, but when rown on artificial media. In addition to this characteristic, Bacillus pyo- yaneus produces energetic proteolytic ferments, which rapidly digest such naterials as gelatin, casein, and blood serum, and it develops with the greatest uxuriance on all media, rapidly crowding out other bacteria with which it nay be associated. It is a flagellated organism, having a single flagellum at ither end of the rod.

Bacillus coli and Bacillus alcaligenes are derived from the intestinal tract, of which they form normal constituents. The first of these was discovered by Emerich in Naples (*Arch. f. Hygiene,* 1885, Bd. 3, p. 291), but was given a comprehensive study and accurate description by Escherich of Vienna (*Fortschr. d. Med.,* 1885, Nos. 16 and 17). It is a normal inhabitant of the alimentary tract of all animals and has, therefore, a wide distribution in nature. Morphologically, it is a short, stumpy bacillus, surrounded by a number of rather short flagella, and possessing what is known as a peritrichic or universal arrangement. When cultivated in the laboratory it grows abundantly, producing a thick, heavy, opaque layer on agar, rapidly acidifying and coagulating milk, failing to fluidify gelatin, and having special relations to the carbohydrates. These are rapidly broken up, with the production of lactic acid, and the evolution of a gas composed of a mixture of hydrogen and carbon dioxide. Practically all the carbohydrates, including dextrose, saccharose, lactose, and maltose, as well as the alcohol mannite, are affected in this manner. Other important characteristics of this bacillus are its production of a fecal odor and the elaboration of the chemical substance known as indol.

Bacillus alcaligenes resembles Bacillus coli in many of its characteristics, but is easily separated from it. Morphologically it is a long slender bacillus, much like the organism producing typhoid fever, and like it possessing numerous wavy flagella. It is readily cultivated artificially, and is especially characterized by its production of a marked alkaline reaction in litmus milk and by its failure to ferment any carbohydrates. It was discovered by Petruschky in 1898 (*Centralbl. f. Bakteriol.,* 1896, Bd. 18, p. 187), and is important from its almost constant presence in the alimentary canal of man and from its resemblance to Bacillus typhosus.

The above-mentioned organisms, Bacillus pyocyaneus, Bacillus coli, and Bacillus alcaligenes are normal to the perineum. Bacillus pyocyaneus is present very frequently on the healthy skin, especially about the folds of the axilla and the groin, and it is the cause of the greenish stain occasionally seen on the underclothing. It is also present with great frequency in the alimentary tract of man, especially in its lower portions and toward the rectum, from which quarter it naturally spreads on to the perineal regions. Bacillus coli and Bacillus alcaligenes are likewise constantly discharged with the feces, and are practically always present in the skin and about the anus.

All these organisms can be readily stained by the use of aniline dyes—gentian violet, methylene blue, and carbol-fuchsin; and they lose the color when treated by Gram's method. While their presence can thus be determined by bacterioscopic methods, it is impossible by these means alone to say to which species the bacilli found actually belong. The specific identification rests upon the cultural reactions.

The capsulated organisms found on the skin of the perineum belong to the group known as "Bacillus mucosus capsulatus," of which the most important member, from our present standpoint, is Bacillus lactis aërogenes. This is a rod-shaped organism which grows as a thick, slimy mass on the surface of agar and of gelatin, and ferments energetically the various carbohydrates, especially starches. When examined by special methods it is seen to be surrounded by a thick, gelatinous capsule, the abundance of which leads to the slimy character of its growth. This organism is very pathogenic to smaller animals, although the first few cultures of it originally obtained by Escherich ("Darmbakterien des Säuglings," Stuttgart, 1886) were devoid of virulence. Like Bacillus coli, it is normally present in the intestine and is thus frequently found on the perineal regions.

BACTERIOLOGY OF THE NORMAL GENITALIA.

The bacteria present on the perineum may invade the external genitalia and almost any species may be found on the labia. The mucous membrane here, however, is especially favorable for the development of the smegma bacillus, which is present in the secretions about the prepuce. The smegma bacillus was discovered by Tavel and Alvarez (*Archives de physiol. norm. et path.*, 1885, t. 7, p. 303), who rightly attributed its importance to its great resemblance to the tubercle bacillus. Like the latter organism, it stains with considerable difficulty, requiring the use of hot, concentrated dyes, but when stained, parts with its color with equal slowness, even resisting decolorization by the action of acids. From this character it is known as an "acid-fast" organism and belongs to the group known as the "acid-fast" group. It is an organism cultivated with some difficulty and must be recognized largely from its morphological and tinctorial properties.

We also find on the mucous surfaces of the labia micro-organisms belonging to the pseudo-diphtheria group, although their presence here is much less frequent than that of other bacteria. The members of this group bear considerable resemblance morphologically to the Diphtheria bacillus, and like it they exhibit a number of granules in their protoplasm, which may be demonstrated by the use of special stains. The best of these is Neisser's, which consists in the application of methylene blue and Bismarck brown, the granules taking the blue color and the cellular protoplasm the brown. There are many members of the pseudo-diphtheria group, the majority of which may be separated culturally from the real diphtheria micro-organism. As Hamilton has recently pointed out (*Jour. Infec. Dis.*, 1904, vol. i, p. 690) some of these organisms closely resemble the Diphtheria bacillus in cultural reactions, and can be distinguished from it only by testing their pathogenic action and their neutralization by diphtheria antitoxin.

Considerable difference of opinion has existed in the past, and still exists among certain observers, as to the extent to which the bacteria of the perineum may involve the vagina. It seems probable, however, from the observations of

Krönig (*Centralbl. f. Gyn.*, 1895, Bd. 19, p. 409) and of Williams (*Amer. Jour. of Obst.*, 1898, vol. xxxviii, No. 4) that in virgins no bacteria exist in the vaginal mucosa, the micro-organisms from the perineum not penetrating beyond the hymen. Even in married women, cultures from the vagina are usually sterile, provided proper precautions are taken by the bacteriologist against the contamination of the culture tubes. A possible exception has been pointed out, however, by Döderlein ("Das Scheidensekret," Leipzig, 1892) who has found a characteristic bacillus in acid vaginal secretions. Döderlein's bacillus is a long, straight organism which grows with difficulty upon ordinary media. It is apparently devoid of pathogenic action, and is regarded by Döderlein as a normal inhabitant of the virginal vagina and as the cause of its acid reaction. Recent experiments by Dührssen confirm Krönig's and Williams' observations, by demonstrating the bactericidal properties of the normal vaginal secretions. Streptococci, Staphylococci, Bacillus pyocyaneus, and the Gonococcus were introduced into the healthy vagina, and cultures taken forty-eight hours later. All the bacteria had disappeared, the Streptococci first and the Bacillus pyocyaneus last. Apparently, therefore, the normal vagina is supplied with safeguards which will protect it from invasion by pathogenic bacteria. The upper portion of the vagina and the endometrium are always sterile.

INFECTIOUS PROCESSES OF THE PERINEUM AND EXTERNAL GENITALIA.

Bacteria play an important part in certain pathological conditions of the perineum and the external genitalia, and these bacteria are usually the pyogenic cocci. Subcutaneous infections, especially those resulting in pus formation, are, in the majority of cases, due to Staphylococcus aureus and Staphylococcus albus, but in rare instances the Streptococcus or Bacillus coli may be found. The Staphylococci and Streptococci are easily recognized simply by bacterioscopic examination, especially if Gram's stain is employed. Infections of certain glands, such as Bartholin's glands, may follow retention of their secretion, and these infections may be due to the pyogenic cocci, which find a portal of entry in the ducts of the glands. Many infections of these glands, however, are gonorrheal in nature.

Of great importance in infections of the external genitalia is our recen knowledge of the etiology of soft chancre, or chancroid. By the researches o Ducrey (*Monatschr. f. prakt. Dermatol.*, 1889, Bd. 9, p. 22) it has been demonstrated that the condition is due to a short, straight bacillus, which may b found in sections taken through the lesion, and which has been proved by inoculation experiments to convey the disease. The micro-organism has recentl been cultivated upon human blood agar, and upon hare's blood by Besançon Griffon, and Le Sourd, in France (*Annales de dermat. et syphl.*, 1901, t. 2 p. 1), while in this country Davis has also succeeded in cultivating it upo similar media (*Jour. Med. Research*, 1903, vol. iv, p. 401).

GONORRHEA.

By far the most frequent cause of bacterial disease of the internal genitalia is now universally recognized to be the Gonococcus of Neisser. This is a small oval diplococcus present in the pus cells of the exudate of acute urethritis. It is one of the few organisms which can be identified by microscopic examination, but its morphological appearance, its staining properties, and its relation to the leucocytes render mistakes in its identification quite needless. It has a peculiar contour, best described as biscuit-shaped, the two oval organisms being approximated by their flat surfaces. It takes the aniline dyes with great readiness, but always loses its color by Gram's method, the decolorization being effected in less than a minute. Finally, it has a characteristic position in regard to the pus cells, lying within the protoplasm of these cells, although occasionally free individuals may be encountered. It varies in number from two to about a dozen, while more numerous collections are rare. The Micrococcus gonorrhoeae has now been successfully cultivated, and in the hands of an expert, cultivation is usually readily accomplished. It grows only upon media to which albumin has been added, this albumin being most easily furnished by hydrocele or ascitic fluid. If these ingredients be added to agar, the Gonococcus develops as a moist transparent layer, but can be kept alive for only a few generations.

If the Gonococcus is introduced into the vagina as a result of illicit intercourse, it causes a variety of pathological conditions, with at times most disastrous results. The first sign of its invasion is an intense inflammation of the urethral mucosa, with the production of a purulent discharge, in the pus cells of which discharge the organism can readily be demonstrated. The pathogenic action of this organism is by no means limited to the urethra. It may, on the one hand, invade the vagina and bladder, causing vaginitis and cystitis, but it is far more apt to penetrate the mucous membrane of the endometrium, and from this point the uterine tubes. The vast majority of the cases of salpingitis are due to the Gonococcus, which may also invade the ovaries and there set up typical abscesses. From the tubes and the ovaries it may spread by contiguity to the peritoneum, when nearly any grade of inflammation of this structure may follow. The inflammation may be limited, for instance, to that portion of the serous membrane in immediate contact with the inflamed tubes or ovaries, being walled off by dense adhesions, or it may spread through the entire abdominal cavity creating an extensive peritonitis with fatal results.

Inflammations originally caused by the Gonococcus by no means always remain limited to this organism. Following upon the changes produced by it, many organisms find favorable conditions for development in the vagina and even in the endometrium. The Pyogenic cocci, Bacillus coli, and other bacteria, which normally are destroyed by the secretions of the vaginal mucosa, quickly develop upon a surface denuded of its epithelium and with its resistance lowered by the invasion of the Gonococcus. Cultures from the vagina in cases of chronic gonorrhea nearly always yield a host of other bacteria, and it is not improbable that the constant presence of other bacteria in the vagina may point to the previous existence of a specific vaginitis. It is a fortunate fact that the Gonococcus can usually be recognized with certainty by a simple microscopic examination. Even in cases of long standing, the micro-organism can usually be recovered from the vault of the vagina, from the cervix, from the urethra, or from the ducts of Skene's glands.

TUBERCULOSIS.

Contrary to the conditions present in gonorrhea, where the agent of the infection can, as a rule, be demonstrated without much difficulty, in tuberculosis of the female genitalia the offending micro-organism is usually found only after long search, and attempts to cultivate it are generally fruitless. The discovery of the tubercle bacillus we owe to Koch (*Berl. klin. Wochenschr.*, 1882, Bd. 19, p. 221), who invented a special stain for its microscopic detection and succeeded in cultivating it upon solidified blood serum. This organism is a long and rather slender bacillus, which stains with great difficulty by ordinary dyes, requiring the application of heat, but when once stained, it retains its color even when treated with mineral acids. The favorite method of staining is known as Gabbet's method, and consists of the use of hot carbol-fuchsin for several minutes, followed by a solution of methylene blue in sulphuric acid. When treated in this way the tubercle bacillus retains the red of the carbol-fuchsin, while the other objects in the field are stained blue. The tubercle bacillus, like the Diphtheria bacillus, exhibits a number of granules in its protoplasm, which have been thought by some to partake of the nature of spores. Proof of their spore-like character, however, is lacking.

Bacillus tuberculosis is the cause of all cases of tuberculosis of the female genitalia, as well as of tuberculosis of the bladder and kidneys, and of the peritoneum. The diagnosis of tuberculosis can usually be made from the pathological findings, but occasionally, though rarely, cases arise in which the diagnosis remains uncertain, the demonstration of the tubercle bacillus being necessary for absolute knowledge as to the etiology of the affection. At times, the tubercle bacillus may itself be demonstrated by bacterioscopic examination of the material, especially if this be pus derived from an inflamed tube or ovary. In other cases, even the most careful examination of a number of stained specimens may fail to reveal the organism, and in all such cases the inoculation of a susceptible animal with the suspected material must be resorted to. For this purpose the guinea-pig is usually selected, inasmuch as this animal is exceedingly prone to experimental tuberculosis. If the inoculated material contain a large number of living tubercle bacilli, the animal will rapidly emaciate, its lymphatic glands enlarge, and death will occur after the lapse of three or four weeks. Preferably the animal may be killed at the end of three weeks and its organs and tissues examined for the presence of anatomical tubercles.

Scrapings from the endometrium must occasionally be examined by this method, although, as a general rule, such material may be hardened, cut, and submitted to microscopical examination. In tuberculosis of the bladder and kidney, the tubercle bacillus can usually be demonstrated in the sediment of centrifugalized urine, but frequently only after a prolonged search, and here, too, animal inoculation must be resorted to with great regularity. This method becomes especially important when the question of a differential diagnosis between the tubercle bacillus and the Smegma bacillus arises.

It is fortunate that the tubercle bacillus can usually be identified by microscopic examination alone, for it is cultivated with considerable difficulty, and only appears on the appropriate media after the lapse of several days or even weeks. The most favorable medium is blood serum or glycerin agar, although it grows fairly well on the surface of broth as a wrinkled membrane. This last method is used in the preparation of tuberculin.

There are a considerable number of bacteria whose staining properties are identical with those of the tubercle bacillus and whose morphology so closely resembles it as to occasionally give rise to doubt and even error in diagnosis. These organisms form the so-called "acid-fast" group, from their universal property of resisting decolorization by acids. The most important members of the group are the Leprosy bacillus and the Smegma bacillus; the latter of which is the only organism likely to be met with in gynecological practice. In all cases where any doubt exists concerning the identification of any acid-fast organisms found, the animal test should be employed, the material being inoculated into some susceptible animal.

CYSTITIS.

Aside from the cystitis produced by the Gonococcus and the tubercle bacillus, inflammation of the bladder wall may occur during the progress of acute diseases, produced by the same organism which is the cause of the disease. The best example of such a condition is the cystitis which may occur during typhoid fever, and for which the Typhoid bacillus is directly responsible. This bacillus is easily cultivated from the urine and can be accurately identified. Morphologically the Typhoid bacillus is long, slender, actively motile, and surrounded by a number of wavy flagella. Its most important cultural reactions are: its failure to coagulate milk, although it produces considerable acidity; its non-liquefaction of gelatin; its acid production in carbohydrate solutions; and, finally, its property of agglutinating with the serum of a patient suffering from typhoid fever, or with the serum of an animal artificially immunized to a known typhoid culture. Other cases of cystitis may occur, due to the passage of bacteria to the bladder from the kidney, in conditions where the natural resistance of the bladder wall is lowered by disease, but by far the larger number of infections of the bladder are the result of artificial interference by contaminated instruments passed into the bladder for the purpose of drawing off the urine, or for the examination of the urinary structures. Almost any species of micro-organism may thus be accidentally introduced, and set up an inflammation of the bladder wall. The **pyogenic cocci** and **Bacillus coli** are most frequent in the milder grades of cystitis, while in rare instances **Bacillus pyocyaneus** has been shown to be responsible for an intense inflammation of this structure (T. R. Brown, *Maryland Med. Jour.*, May, 1900).

Contrary to the view generally accepted in this country, the German authorities, especially Flügge, consider **Bacillus lactis aërogenes** the most important micro-organism concerned in the production of cystitis ("Die Mikroorganismen," 1896, Bd. 2, p. 340). This micro-organism resembles **Bacillus coli** in its growth on ordinary media, and is easily confused with it. It is quite possible, therefore, that some of the cases of cystitis stated to be due to this organism may in reality be due to infections by **Bacillus lactis aërogenes**.

INFECTIONS OF THE INTERNAL GENITALIA.

Infections of the internal genitalia may occur during surgical interference with these structures, but by far the majority of such infections occur during childbirth, and the pathological lesions produced by the invading microorganisms must be dealt with by the surgeon. Aside from the fact that the uterine structures are especially disposed to infection in childbirth, as the result of a vast destruction of tissue at this time, the micro-organisms concerned in, and the changes resulting from their invasion are the same whether the infection occur during confinement or during the course of surgical operation. To the one group of infections we have given the name **puerperal infection**, or puerperal fever, and in infections of this nature the bacteria are usually introduced by the examining finger of the accoucheur. In the other group, the source lies in the contaminated instruments employed by the operating surgeon. The results of the bacterial invasion are the same in all cases, depending primarily upon the site of the infection and upon the pathogenic properties of those bacteria which may be accidentally introduced.

In uterine infections with the **Staphylococcus aureus** and the **Staphylococcus albus**, and usually with the **Bacillus coli**, the inflammation is limited to the surface of the endometrium, the bacteria seldom penetrating far beneath the surface epithelium. The same is true of infections by certain varieties of **streptococci**, but the majority of **streptococci** possess marked invasive powers and rapidly extend through the entire uterine tissue, from which they may be carried by the blood and lymphatics to the general peritoneum. They may also reach this structure by direct extension through the uterine wall. In all cases, the peritonitis set up by this organism is most virulent in character, and is usually accompanied by a septicæmia in which the **Streptococci** are universally distributed through the body. This variety of puerperal infection is probably the most fatal known. The **Staphylococci** may also be carried by the blood and lymphatics from an infected uterus to the general peritoneal cavity, but in this case the resulting peritonitis is more apt to be local in character, with the production of considerable quantities of fluid pus. At the same time metastatic abscesses may occur in different parts of the body and a condition of *pyemia* is produced. The abscesses may discharge in various localities and the disease assumes a chronic character, frequently with fatal results.

In infections by both the Staphylococci and the Streptococci, these organisms may be readily detected in scrapings made from the uterine mucosa, although it must not be forgotten that occasionally a coincident gonorrheal infection may be lighted up at the time of delivery and a rapid extension of the Gonococcus to tubes and peritoneum take place.

One of the most important agents in puerperal infection, and one the importance of which is more appreciated every year, is the anaërobic bacillus discovered a few years ago by Welch and Nuttall in the blood and tissues of a man dead of thoracic aneurism; it has since been observed in a variety of pathologic conditions and described under a number of different names by other observers. The Bacillus aërogenes capsulatus of Welch and Nuttall, or the "gas bacillus" as it is usually called, is a rather large bacillus, which stains easily by ordinary dyes and retains its color when treated by Gram's method. It is non-motile, and is surrounded by a gelatinous capsule which can be demonstrated by appropriate means, the best of which was devised by Welch, and consists in the application of glacial acetic acid to precipitate the mucin, followed by gentian violet. The specimen should then be examined in salt solution, as both water and balsam dissolve out the capsular substance. The gas bacillus grows only under anaërobic conditions, that is, with the exclusion of oxygen from the culture tubes, but under these conditions has a characteristic appearance on various media, especially if carbohydrates are added. Owing to admixture with other bacteria the Bacillus aërogenes capsulatus can seldom be obtained in pure culture by the ordinary methods. The best means of obtaining it is the intravenous inoculation of a rabbit with the suspected material, the animal being killed in five minutes, and then placed in a warm place to allow the organism to develop in the tissues. After the lapse of a few hours, if the material contains the gas bacillus, the rabbit will become enormously distended with gas, the blood and internal organs presenting a characteristic appearance. Bubbles, or blebs full of gas are everywhere present, especially in the blood vessels and in the fascia between the layers of muscles, while the liver presents a number of gas cysts, a condition seen in no other infection. The gas bacillus produces spores which enjoy the widest distribution in nature. They may be found in the soil, in milk, in natural waters, in the dust of streets and buildings, as well as in the intestinal contents of man and the majority of domestic animals.

While the pathogenic properties of this bacillus are many and varied, it is more especially prone to set up puerperal infections. At the time of delivery, when the placenta is separated from the uterine mucosa, the necrotic tissue there present offers the most favorable pabulum for this organism, which is best able to invade tissues whose vitality is markedly reduced. Owing to its wide distribution in nature, it may readily be introduced into the endometrium during confinement. As was originally predicted by Welch, practically all those cases of death in the puerperium, ascribed by older writers to the entrance of air into the uterine sinuses, are in reality due to infection by this bacillus, the rapid development of which immediately following death gives rise to the presence of gas in the blood and organs. The **gas bacillus** is not only the cause of uterine infections, but it may also be transmitted to the fetus, producing emphysema of the fetal structures, as in a case reported by Dobbin.

Somewhat rarer cases of puerperal infection are produced by micro-organisms whose growth is limited to local structures, but whose deleterious effects upon the individual are due to the elaboration of powerful extracellular toxins. The most important of these are the **Diphtheria bacillus** and the **Tetanus bacillus**. The **Diphtheria bacillus** was discovered almost simultaneously by Klebs and by Loeffler, and is usually known as the Klebs-Loeffler bacillus. It is a long, slender, non-flagellated organism, in whose protoplasm there are a number of granules, best demonstrated by Neisser's stain. Owing to the prevalence about the vulva of pseudo-diphtheria organisms, which so closely resemble the real **Diphtheria bacillus**, its absolute identification must rest upon animal experimentation, including especially the neutralization of its toxins by diphtheria antitoxin. A few cases of vulvar infection by the **Diphtheria bacillus** have been reported by Nisot, by Brunn, and by Williams, and in all these cases there was no doubt as to the nature of the infection. The **Tetanus bacillus**, like the **Diphtheria bacillus**, secretes a powerful extracellular toxin, but this is probably a rare agent in puerperal fever. It is a spore-bearing organism, whose spores are quite resistant, and widely distributed in nature; it is on this account of great importance. Morphologically, it is a long, slender bacillus with a small glistening spore situated at one end of the rod. It grows only under pure anaërobic conditions, and in the identification of suspected material it is usually more advantageous to inoculate susceptible animals than to attempt its cultivation.

CHAPTER IV.

TOPOGRAPHICAL ANATOMY.

1. Difference between infantile and adult uterus and adnexa (Figs. 15 and 16, p. 50).
2. Superficial and deep layers of abdominal muscles (Figs. 17 and 18, p. 52).
3. Scheme of relations of muscles and fascia of the abdominal walls in transverse section (Figs. 19 and 20, p. 54).
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5. Topography of termination of ileum and vermiform appendix (Fig. 23, p. 58).
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28. Interlacement of fibers of anterior levator muscle with those of the internal sphincter muscle of the rectum (Fig. 47, p. 81).
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A KNOWLEDGE of anatomy and physiology is just as essential to the gynecologist as a familiarity with the general principles of surgery; indeed, the very foundation stones of successful work are laid in envisaging the relations of the parts to be dealt with so clearly that the operator divides layer from layer almost as if the coverings of the body were transparent. Without this accurate knowledge of the component parts of the pelvis and abdomen and their mutual relations, to be gained only by actual dissections, surgery is not an art, but at best a haphazard procedure guided by luck; without a knowledge of physiology, an operator will often ruthlessly sacrifice organs or parts of organs whose functional activity is essential to the happiness and well-being of the patient.

I wish to emphasize these facts because so many men enter the ranks of

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gynecology from general practice with only such medical training as is given in the schools—insufficient to make them safe operators.

I shall not attempt in this chapter to describe the pelvic anatomy as it is laid down in the various accessible manuals for dissectors, but shall rather take up the anatomy of the abdominal pelvic viscera, first, as they are approached in an operation from above, and then from below, purely from the practical standpoint. Descriptions of the relations of organs are so lifeless without satisfactory pictures that I have confined the text for the most part to the description of topographical drawings. These are all, with two exceptions, from original dissections.

From birth down to the period of full sexual maturity of women, there is a gradual progressive change in the position and relations of the pelvic viscera—in fact, in the infant the bladder and the uterus can be named "pelvic viscera" only by reference to what they are to become, for at this early period both organs lie above the superior strait among the other abdominal organs, as shown in the figure drawn from a frozen section of a mature newborn child.

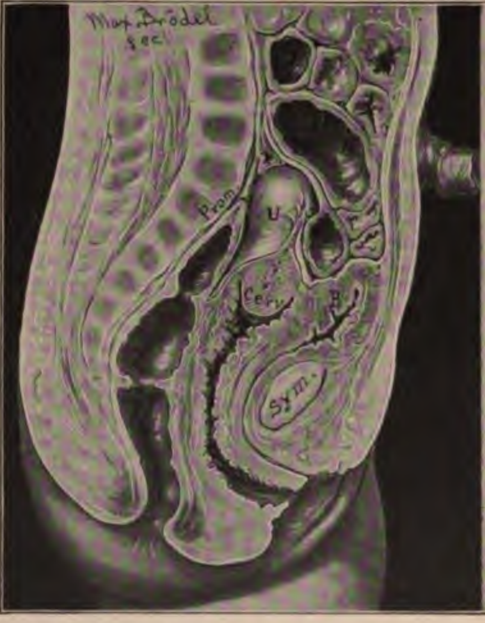


FIG. 15.—INFANTILE PELVIS, NATURAL SIZE, SEEN IN SAGITTAL SECTION.

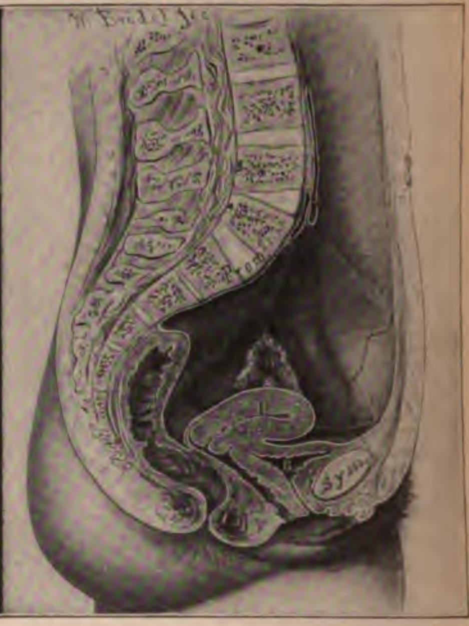


FIG. 16.—PELVIS OF ADULT WOMAN IN SAGITTAL SECTION, REDUCED TO THE SAME SIZE AS AN INFANTILE PELVIS FOR COMPARISON.

The comparison between the infantile and the adult pelvis is well shown by placing beside a child's pelvis of natural size that of a fully developed woman, reduced to correspond. (Figs. 15 and 16.)

One of the most striking differences to be noted is the alteration in the direction of the axis of the pelvis; in the child this is a simple straight prolongation of the abdominal cavity, in the woman the pelvic axis is set at a marked angle. While the uterus in the adult is seen lying in anteflexion wholly within the pelvis, at an acute angle with the vagina, with well-developed corpus and small cervix, in the infantile pelvis the uterus lies almost wholly within the abdomen, as a rule compressed between the rectum and bladder in an upright position, without any angle of flexion. In the example figured the uterus lies on the left side of the median line and is cut through close to the cervix; the fundus rests on the last lumbar vertebra, and the mesentery of the small intestine is situated in front of it between the uterus and bladder. The cervix is large as compared with the fundus; the long rugose vagina lies just anterior to the axis of the pelvis, following its curve, and without the sigmoid curve, which is so characteristic in the adult.

The thick-walled bladder lies in the anterior part of the pelvic cavity just above the symphysis. The almost straight rectum is divided into three cavities by two valve-like folds of mucosa, the lower one situated just above the middle of the vagina, on a line drawn from the lower border of the symphysis to the coccyx; the upper one opposite the vaginal vault. The umbilicus, as in the adult, is opposite the second lumbar vertebra.

The Abdominal Muscles.—Fig. 17 shows the oval contour of the abdominal cavity, covered by the external and internal oblique muscles; the right and left recti muscles form strong bands, uniting the symphysis pubis to the cartilages of the 5th, 6th, and 7th ribs, and ensiform process; they are bound together in the center by the linea alba and bordered on their outer margins by the semilunar lines. The rectus muscle is divided by three transverse tendinous intersections, one at the umbilicus and two above it. The sheath of the right rectus is opened below, showing the right pyramidalis muscle, which arises by a narrow base from the symphysis pubis and extends upward one third of the way to the umbilicus, overlying the rectus.

The semilunar line on the left is seen about halfway out between the median line and the left lumbar region, looking at the body from the front. The external oblique muscle is well shown on this side with its fibers radiating from the costal margin and the left lumbar region out toward the rectus of the same side. Below, just above Poupart's ligament, the parting of the fibers is seen at the external ring out of which the round ligament emerges. The position of Poupart's ligament between the spine of the pubis and the anterior-superior spine of the ilium is clearly indicated by the white band.

On the right side the external oblique muscle has been dissected off and reflected upward, exposing the internal oblique muscle; the tendinous aponeurosis has been detached from the anterior lamella of the sheath of the rectus as far forward as the dissection could be carried.

Fig. 18. The deepest of the three muscular layers forming the abdominal walls are formed by the right and left transverse muscles, whose fibers run horizontally. The external and internal oblique muscles have been reflected, the external being turned up and the internal divided and turned both up and down on the margins of the ribs and Poupart's ligament.

The left rectus muscle is exposed with its pyramidal muscle below, and on the right, the rectus has been divided in the middle, showing the transversalis fascia, which forms its sheath posteriorly, extending from the margin of the ribs down to the semilunar fold of Douglas, which lies at a point about 3 cm. below the umbilicus. Below this point the thin tissue allows the convolutions of the intestines to be seen through the fascia and peritoneum. The

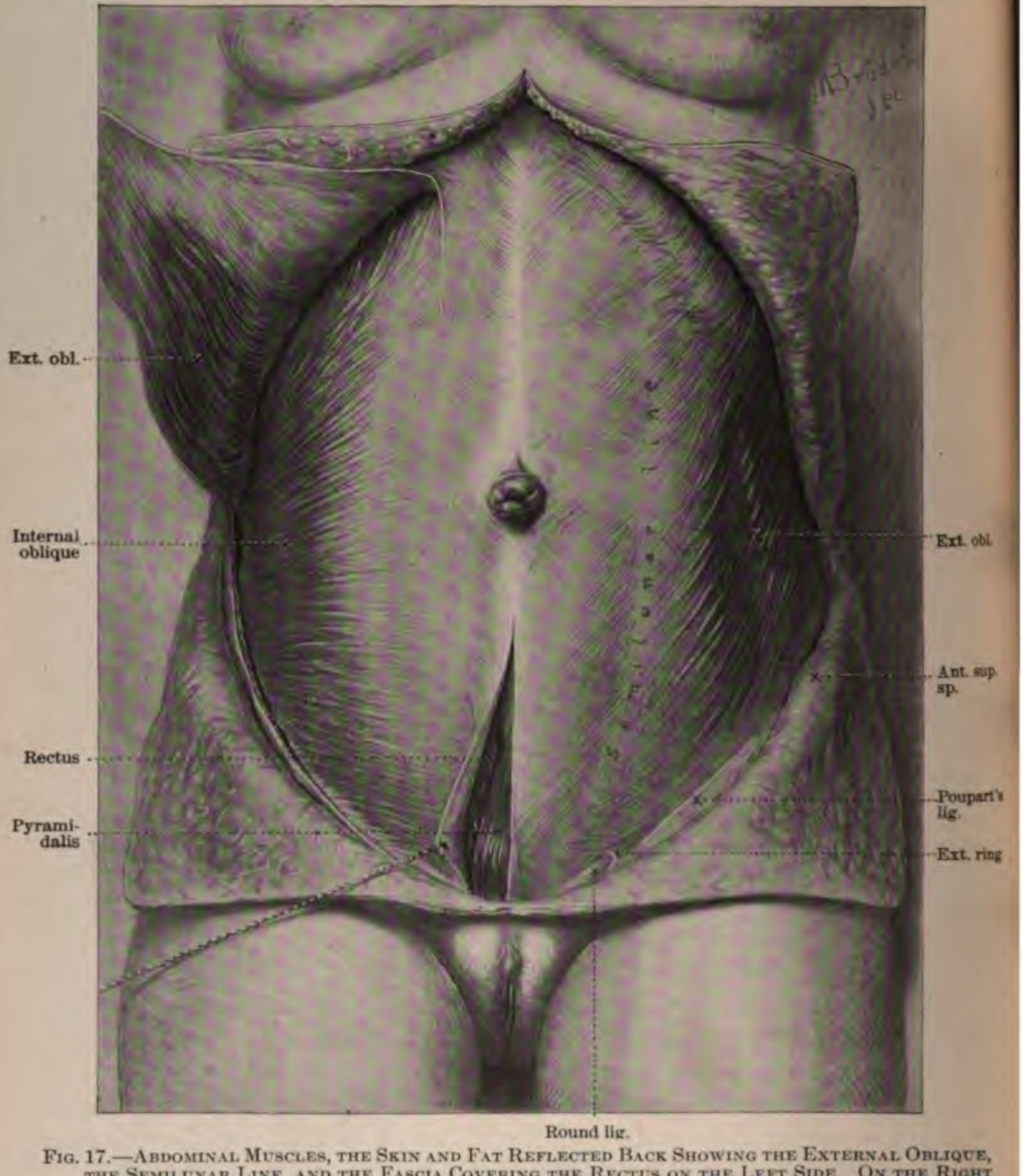
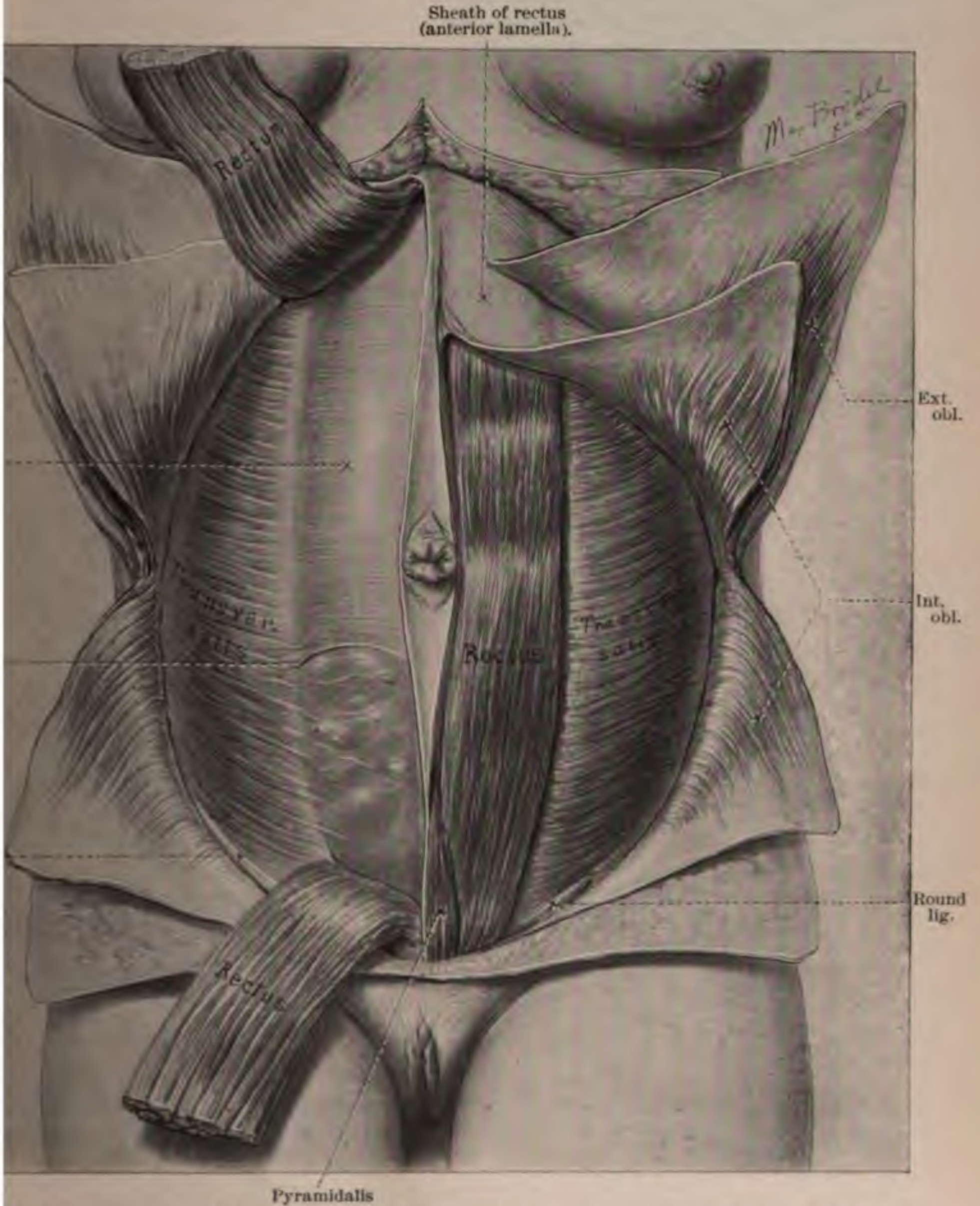


FIG. 17.—ABDOMINAL MUSCLES, THE SKIN AND FAT REFLECTED BACK SHOWING THE EXTERNAL OBLIQUE, THE SEMILUNAR LINE, AND THE FASCIA COVERING THE RECTUS ON THE LEFT SIDE. ON THE RIGHT SIDE THE EXTERNAL OBLIQUE IS REFLECTED UPWARD SHOWING THE INTERNAL OBLIQUE. THE PYRAMIDALIS IS SEEN LYING WITHIN THE RIGHT RECTUS SHEATH.

minal wall below the semilunar line owes the thinness of its fascia, pos-
r to the rectus, to the passing of the transversalis fascia in front of the
s below the semilunar line.

'igs. 19 and 20. The scheme of the relations of the muscles and fascia of
bdominal walls as they are seen in transverse section has been made accord-



8.—On the Left the Internal Oblique is Reflected, together with the External Oblique
nd the Sheath of the Rectus, in order to Show the Transversalis Muscle and the Left
ectus. On Dividing the Rectus in the Middle, as shown on the Right Side, the Tendi-
ous Posterior Sheath is Seen above, Ending at the Semilunar Line below the Umbilicus.

ing to Braune. Fig. 19 shows the section of the walls above the semilunar folds of Douglas, and Fig. 20 shows the section below the folds of Douglas. Both pictures exhibit the relations of the oval recti to the transverse and the internal and external oblique muscles.

In the section above the folds of Douglas, Fig. 19, it is important to notice the relation of the aponeurosis, indicated by the white spaces between the muscles. The division of the fascia of the internal oblique muscle is seen at the rectus, one lamella passing in front to unite with the fascia of the external oblique, the other lamella passing posteriorly to join the transversalis tendon, and so to continue as a conjoined tendon until it unites with its fellow of the opposite side.

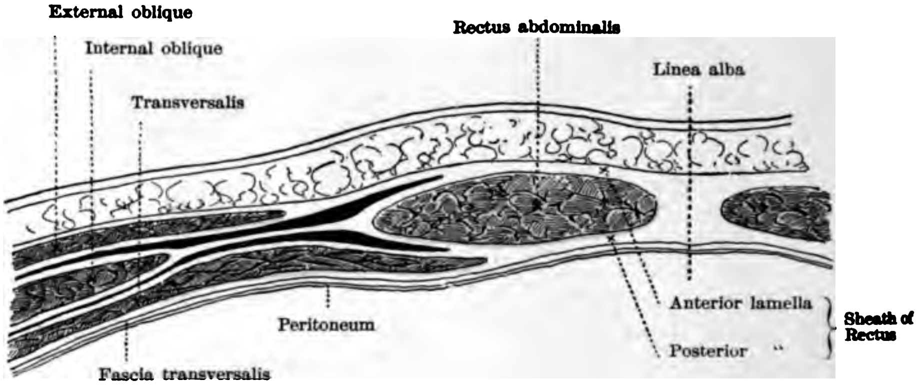


Fig. 19.—A Transverse Section of the Body above the Semilunar Folds.

In Fig. 20 quite a different arrangement of the muscles is seen; the external oblique muscle remains about the same, while the internal oblique advances much closer to the rectus, and the transversalis, instead of passing behind the rectus, as in Fig. 19, lies farther back toward the lumbar region than either of the others. In Fig. 20 the fascia of the external and internal

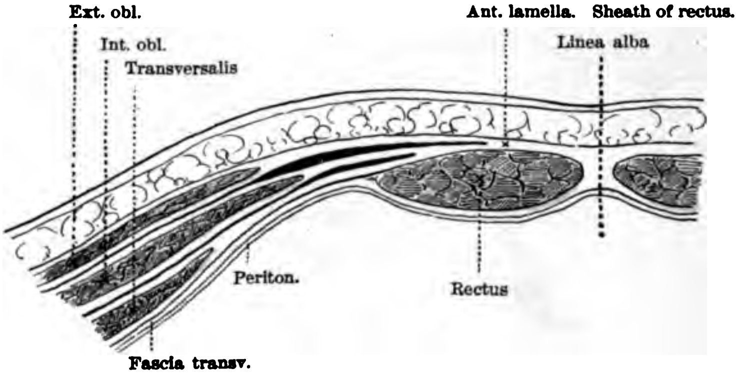


Fig. 20.—A Transverse Section of the Body below the Semilunar Fold, showing the Absence of the Posterior Fibrous Sheath behind the Rectus as well as the Relation of the Difference of the Muscles.

oblique muscles blend at a point nearer the median line, as shown also in Fig. 19. The internal oblique also fails to split, sending its entire tendinous aponeurosis in front of the rectus along with that of the transversalis muscle.

After cutting through the fascia we encounter what I have for some years been in the habit of calling "the celiotomy veins." In opening the abdomen in the linea alba in its lower third, these veins are almost invariably found lying just over the peritoneum. Sometimes there is but one large vein 1½ or 2 mm. in diameter, but usually there are two of them from 1 to 1½ mm. in diameter, separated by an interval of 3 or 4 mm.; they follow a slightly winding, but in general straight course down to the symphysis pubis, over which they pass to the neck of the bladder, where they empty into the large vesical plexus of veins. I have not seen any arteries accompanying these veins. They are usually large enough to give rise to some persistent oozing, if injured, and for this reason should be carefully observed in every case, in order to cut between them, or to one side when there is but one vein. In a series of twenty abdominal sections, taken consecutively, the celiotomy vein was seen sixteen times; in most cases it ascended straight up the median line just beneath the peritoneum, a little to the right or to the left; six times it was seen bifurcating. In four cases the diameter was at least 2 mm., in all the rest it was less than 2 mm.

The Topographical Anatomy of the Small Intestines.—Figs. 21 and 22 have been drawn directly from the subject to demonstrate important points in the topographical anatomy of the small intestines. This subject has been carefully worked up by D. Sernoff (*Internat. Monatschr. f. Anat. u. Phys.*, Bd. xi, 1894) and others, and elaborated with important additions by Dr. F. P. Mall, whose demonstrations have been followed in preparing the figures.

In order to expose the intestines in their normal positions, the abdominal cavity has been opened by a crucial incision, and each of the four flaps reflected outward. Letters have been placed upon the small intestines, associating them in groups. Each one of these groups is so attached to a series of lamellæ of the mesentery that by picking up one of the groups of lamellæ at its base near the vertebral column, the entire bunch of small intestines attached to it is also lifted up.

In describing the groups I begin at the duodenum, Fig. 21, and note the lamellæ under the left splenic flexure of the colon included in the letters A and B; from this group the mesentery crosses the vertebral column to the right side, where it forms a series of folds under the right hepatic flexure of the colon; this group is included between the letters B and C; crossing the vertebral column once more to the left, the next group is found lying in the left iliac fossa, included between the letters C and D; the fourth and last group of lamellæ, between D and E, fills the lower abdomen and right iliac fossa, and it is particularly important to note the straight line of the terminal portion ascending from the pelvis to the head of the colon as the mesentery rapidly shortens from its extreme length down to nothing at all. The only loops of the intestines which in all cases cross the median line are those going from the first to the second and from the second to the third groups. The oblique attachment of the mesentery is well shown, extending from above downward and from left to right, in striking contrast to the more horizontal attachment found in the fetus. I have shown the relations of the folds of the mesentery in Fig. 21 in order to simplify the study of the relations of groups of intestines attached to them. In glancing at Fig. 22 it will at once be seen that while the relations of the mesenteric folds appear comparatively simple, the relations of the intestinal loops, which are precisely the same, appear much more complicated.

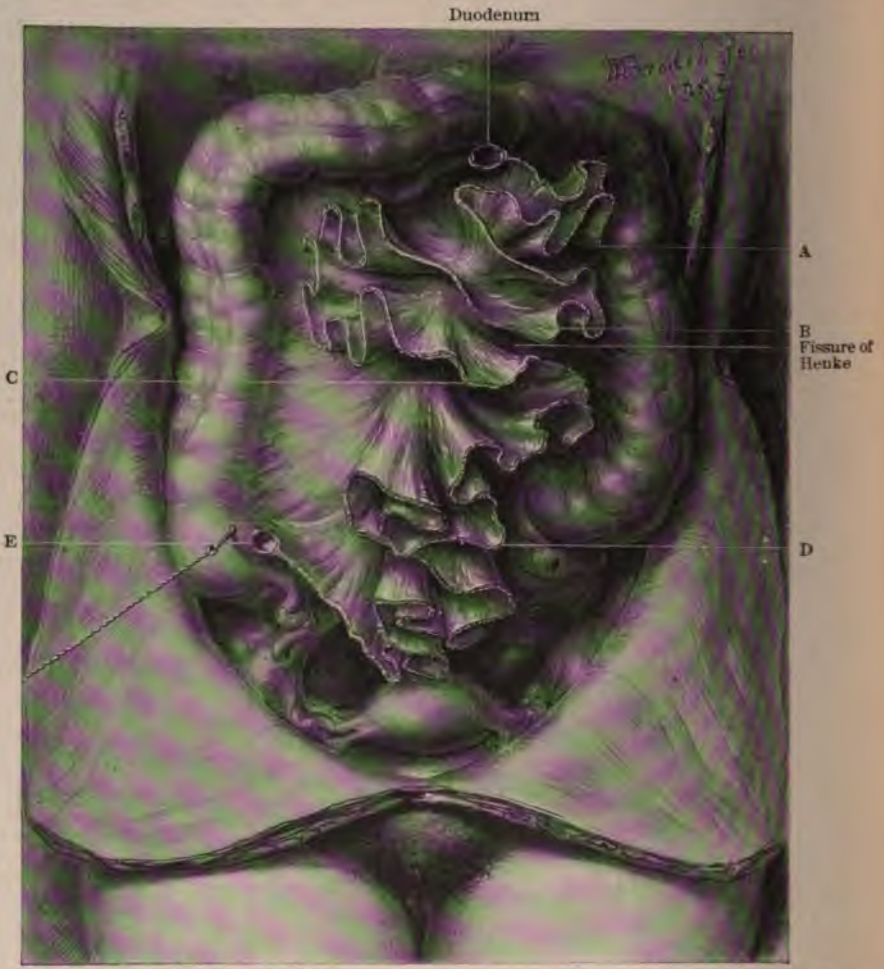


Fig. 21.—The Folds of the Mesentery Showing their Usual Orderly Arrangement in Groups Following the Order of the Letters A, B, C, D, E. Note the Fissure of Henke between B and C.

The cadaver from which the drawings have been taken, represents the average normal relation as found in 21 out of 40 cases examined by Dr. Mall.

In order to facilitate the study of the groups of intestines, of which I have just described four, the same letters are used, marking the same divisions seen in the preceding figure. The figures accompanying the letters in Fig. 22 indicate the superficial direction of the bowel. Sernoff found that the exposed or

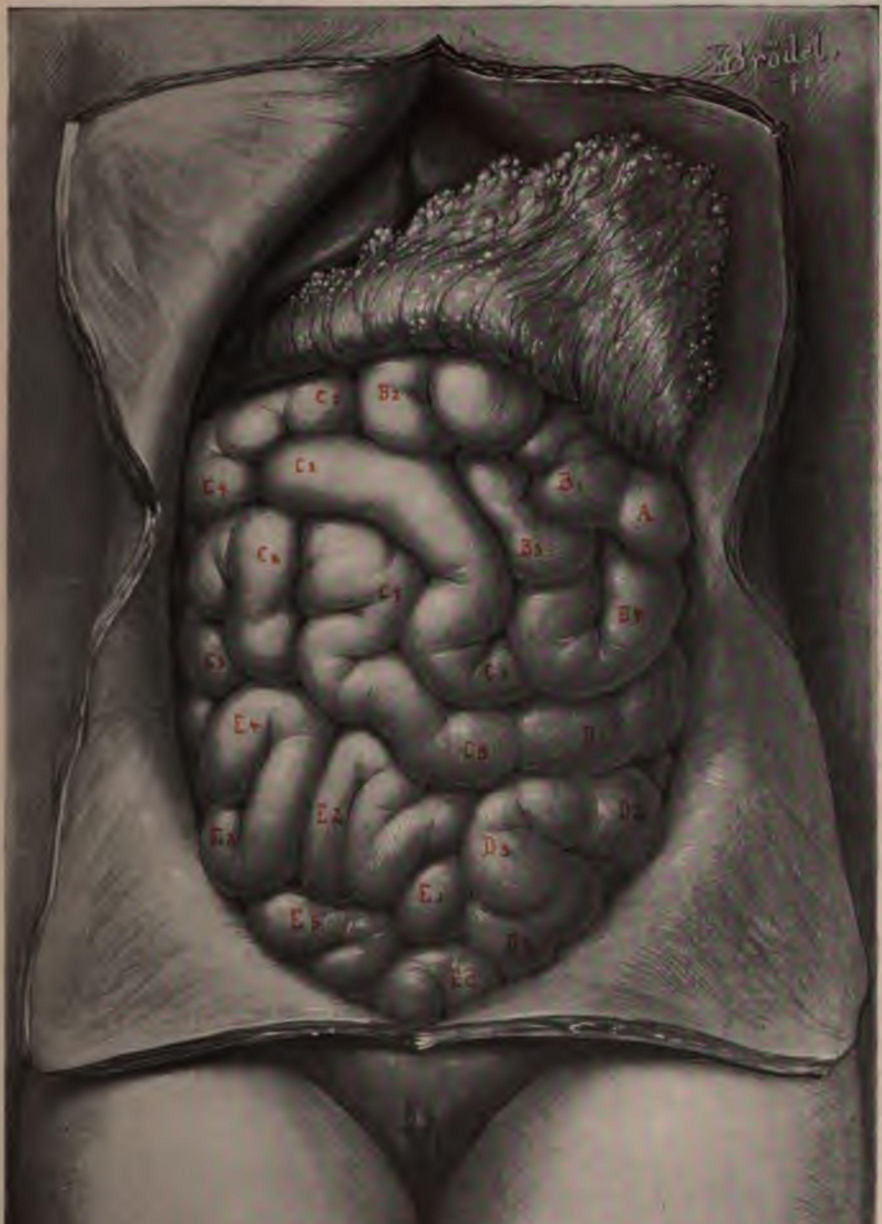


FIG. 22.—SHOWS THE VARIOUS GROUPS OF THE SMALL INTESTINE CORRESPONDING TO THE LETTERS IN FIG. 21.

peripheral part of the intestines constituted only about one sixth of the entire length of the canal from duodenum to cecum; the average length of the small intestine, according to Sernoff, is 537 cm. The distance from B_1 to B_2 and from B_2 to B_3, etc., by no means represents a uniform space. Group B (Fig. 22) of the bowels lies under the left splenic flexure of the colon, and, by passing the hand down to the mesentery at this point, can be picked up *en masse.* Group C, under the hepatic flexure of the colon, can be picked up by carrying the hand down to the mesentery between the colon and small intestines; by throwing this group over to the left side, the whole of the right renal region is exposed. Below B and above C there is a natural fissure or separation between the bowels (fissure of Henke) which goes all the way back to the psoas muscle.

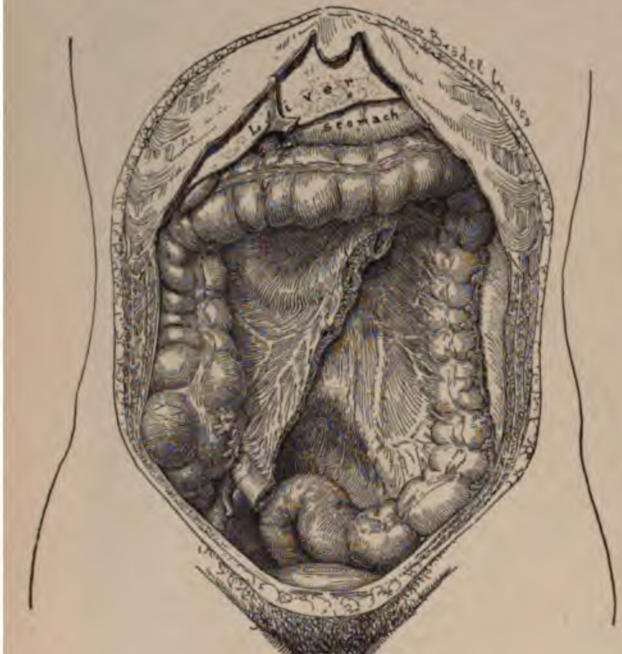


FIG. 23.—NORMAL POSITION OF ILEOCECAL APPARATUS. THE APPENDIX IS USUALLY NOT VISIBLE UNTIL THE CECUM IS LIFTED OUT OF THE ILIAC FOSSA.

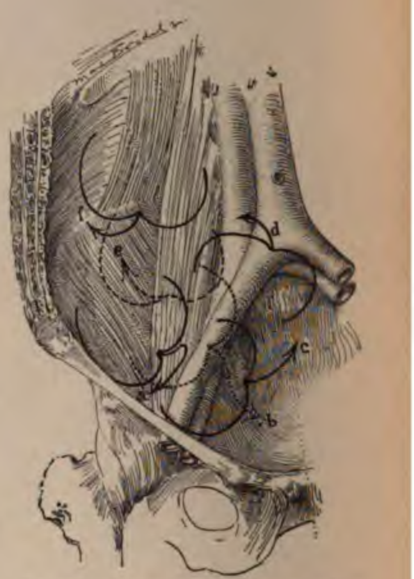


FIG. 24.—DIAGRAM SHOWING THE POSITIONS OF MODERATE DISPLACEMENTS OF THE APPENDIX, WHILE IT IS STILL FOUND IN THE RIGHT LOWER QUADRANT OF THE ABDOMEN.

The following variations in relation to these groups are often found:

Variation 1: Group C is displaced from its position under the right hepatic flexure over into the left flank.

Variation 2: Group B crosses the median line and occupies the position of Group C under the hepatic flexure, while Group C goes to the left.

Variation 3: Group C goes down to the left, and groups B and D go across and ascend on the right to occupy its place.

Almost all anatomical drawings of the abdominal cavity fall into the error of placing the anterior abdominal wall at too great a distance from the lumbar vertebræ; the separation between the two will vary according to the distention of the intestines, which float up and push the wall forward, especially in the erect posture, and so lift it 2, 3, 5, or more cm. from the promontory of the sacrum; as the intestines contract they retire to the upper part of the abdomen, to the right and left flanks, and to the pelvis; this is more marked in the recumbent position.

In emaciated patients the anterior abdominal wall may not infrequently be found so closely applied over the lower part of the vertebral column that its rounded form is plainly seen. In one of my abdominal operations, after removing an extensively adherent parovarian cyst, the collapsed walls actually became adherent to the vertebral column, causing the patient great discomfort in her convalescence.

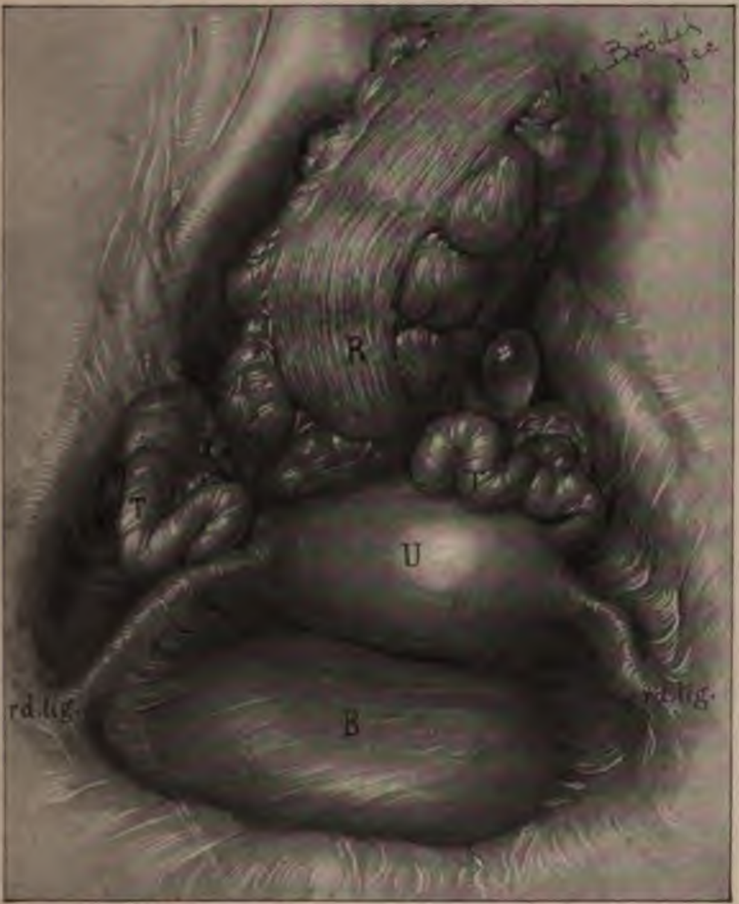


Fig. 25.—The Pelvic Viscera, Showing the Uterus Lying a Little to the Left, Being Crowded Over by the Rectum Lying Somewhat More than Usual to the Right. In the Angles at the Sides Lie the Uterine Tubes and Ovaries. The Bladder is Limited in Front by the Round Ligaments.

The Large Intestine.—Fig. 23. It is particularly important to the gynecologist to be familiar with the anatomy of the terminal portion of the ileum, that part of the intestine which is most liable to drop into the pelvis and to be involved in the various inflammatory gynecological processes.

Fig. 23 shows the cecum in the right iliac fossa with its longitudinal fibers leading down to the vermiform appendix, which lies coiled above the common iliac artery on the psoas muscle. The straight ascent of the ileum out of the pelvis and over the sacro-iliac junction to its point of exit in the cecum is especially noteworthy. This arrangement appears to be a mechanical necessity due to the triangular form of the end of the mesentery which terminates at the cecum in a point. See also Fig. 21.

Fig. 24 shows the various positions within the right lower quadrant in which the appendix may be found. *a, b, c, d* are determined by the length of the mesentery, while *e* and *f* are congenital forms due to incomplete descent.

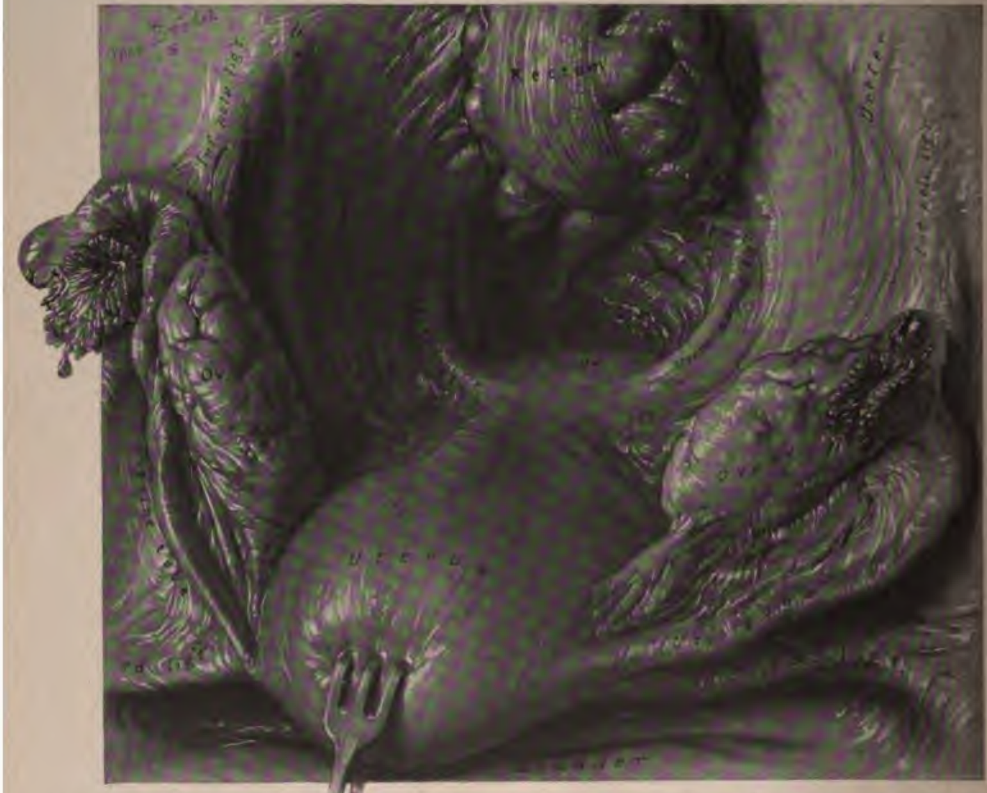
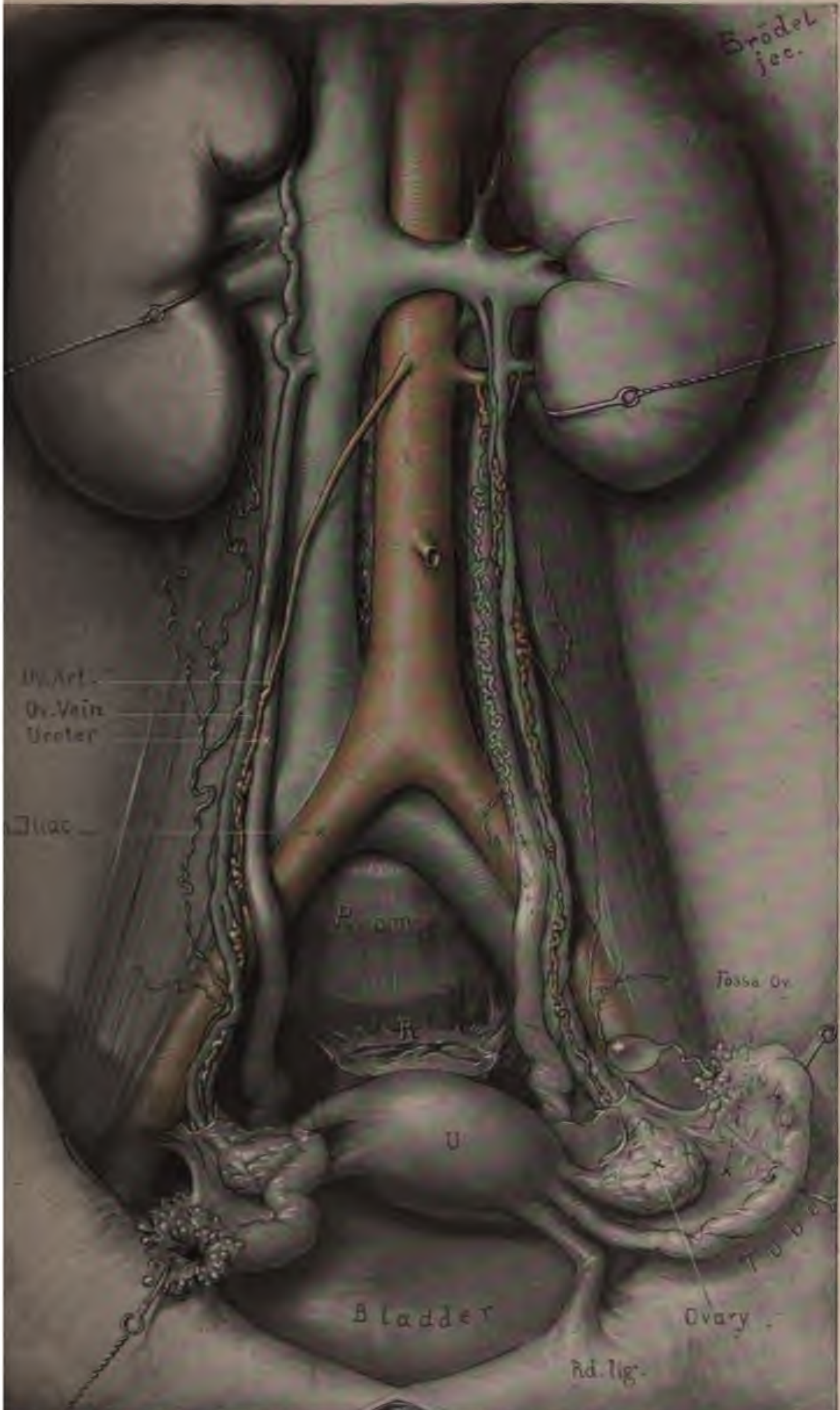


FIG. 26.—THE UTERUS PULLED OUT OVER THE SYMPHYSIS, DISPLAYING ITS LATERAL STRUCTURES MORE CLEARLY. THIS FIGURE IS ESPECIALLY DESIGNED TO SHOW THE UTERO-SACRAL LIGAMENTS BELOW WITH DOUGLAS' CUL-DE-SAC. THE URETERS ARE SEEN THROUGH THE PERITONEUM AT THE SIDES.

The Pelvic Viscera.—Fig. 25 shows the mutual relations of the pelvic viscera as seen upon opening the abdomen through the superior strait. The drawing is after nature exactly, and, although presenting some slight indi-



27.—THE GREAT VASCULAR TRUNKS OF THE LOWER ABDOMEN WITH THE OVARIAN VESSELS IN THEIR RELATIONS TO THE RENAL VESSELS, THE AORTA, AND THE VENA CAVA.

vidual peculiarities, does not deviate in any important particular from the average case.

The bladder in front is moderately distended, somewhat gibbous in form, and fullest on the right side. The rectum passes down into the pelvis to the right of the promontory of the sacrum, necessitating a slight left lateral displacement of the uterus, which lies between the rectum and the bladder; this has the effect of lengthening the right and shortening the left round ligament, and of causing their curves to differ. The tubes and ovaries on each side fill up the triangular spaces left between the rectum and uterus and the pelvic walls. One important consequence of the lateral displacement of the uterus is found in the closer approximation of the left ureter to the cervix.

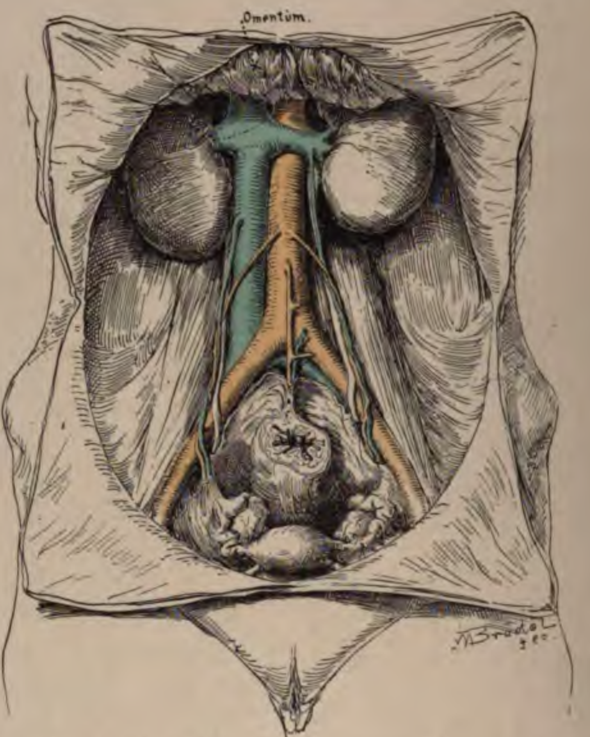


FIG. 28.—THE COMMON METHOD OF ORIGIN OF THE OVARIAN VESSELS.

Fig. 26 shows the utero-sacral ligaments coursing from the cervix on the right and left in a curved line around the rectum. Below and between the ligaments in front of the rectum lies Douglas' *cul-de-sac*.

The next dissection (Fig. 27) exposes the **great vascular trunks of the lower abdomen and pelvis.** The aorta is seen above on the left, bifurcating in front of the last lumbar vertebra into the right and left common iliac arteries; the right iliac lies upon the common iliac vein, concealing it, while the left lies above and to the outside of the vein.

The ureters are seen descending from the kidneys into the pelvis; their upper extremities lie concealed behind the renal vessels. In the upper half of their course they lie posterior to the ovarian vessels, but in the lower half, the ureters cross and lie to the inside of the ovarian vessels, dropping into the pelvis over its brim, from 2½ to 3 cm. to the right and left of the promontory. The distance between them at the pelvic brim is about 5 cm. The nutrient vessels accompanying the ureters are clearly seen on their surface, and on the left side there is an unusually injected, large, tortuous vein. The right ovarian artery is seen springing from the aorta, while the left, in the dissection before us, arises from an aberrant renal artery. Fig. 28 shows the common method of origin of the ovarian vessels. The ovarian vein on the

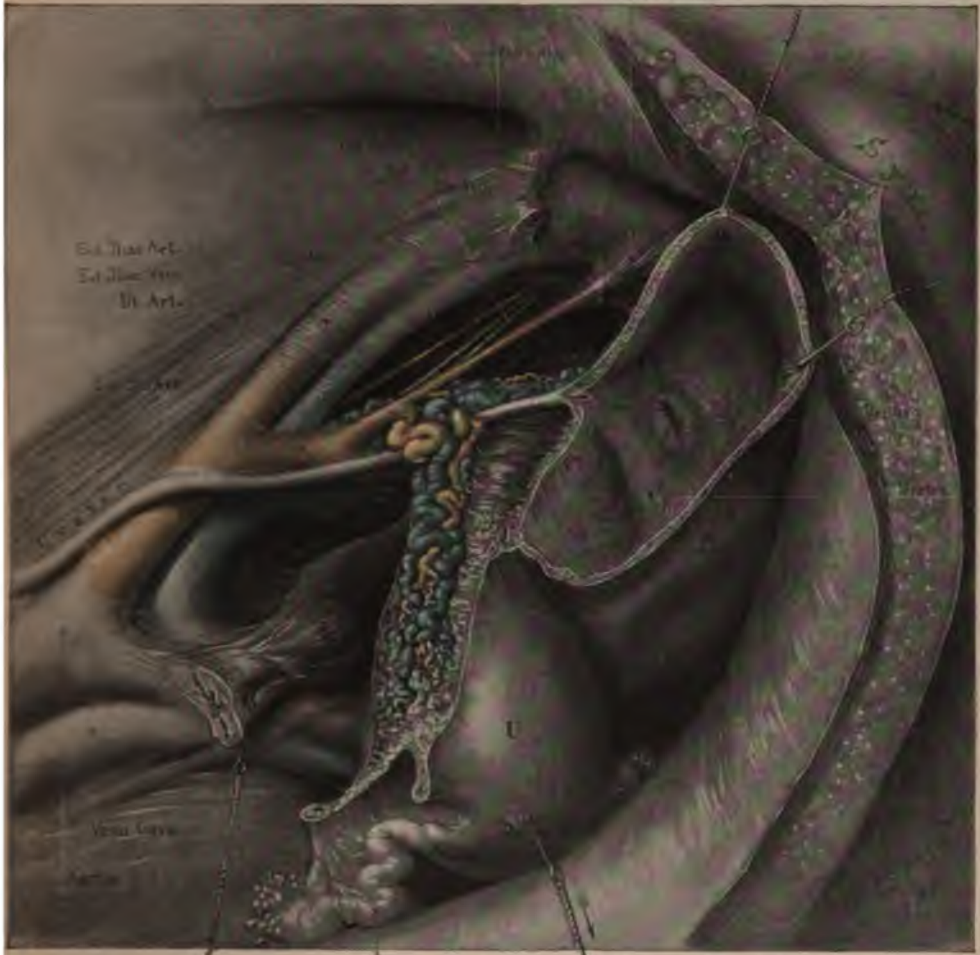


FIG. 29.—THE UTERINE VESSELS IN THEIR ORIGIN AND DISTRIBUTION, SHOWING ESPECIALLY THEIR RELATIONSHIP TO THE LEFT URETER.

right side receives the inferior adrenal vein (rare) and empties into the vena cava at an acute angle, while that on the left empties into the left renal vein at a right angle; the mechanical disadvantage of the left side, as compared with the right, causes greater pressure, and hence a more marked distention of the vessels on the left. On the right side three veins are seen in the pelvis in the neighborhood of the ovary, and as they ascend toward the brim two of

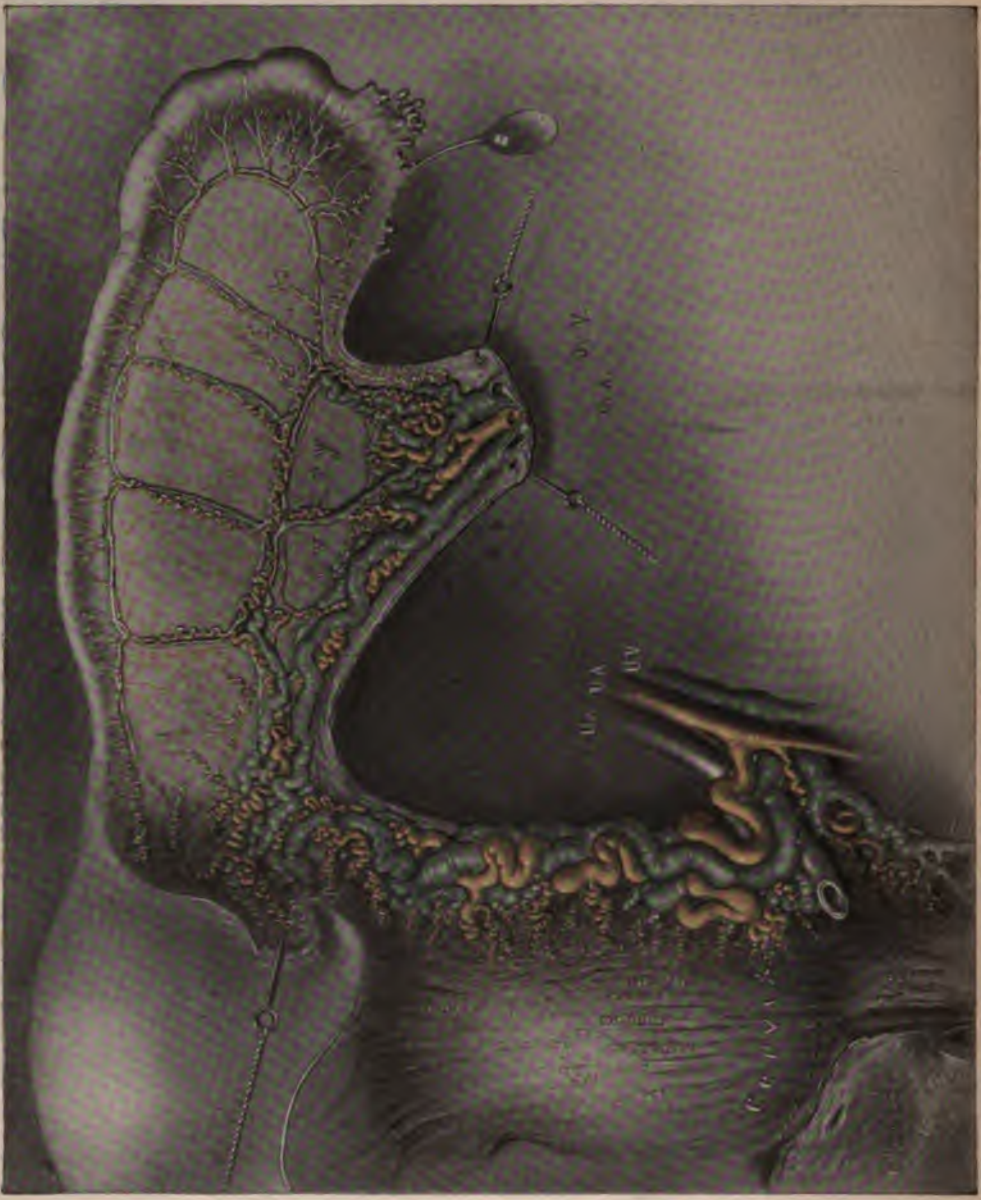
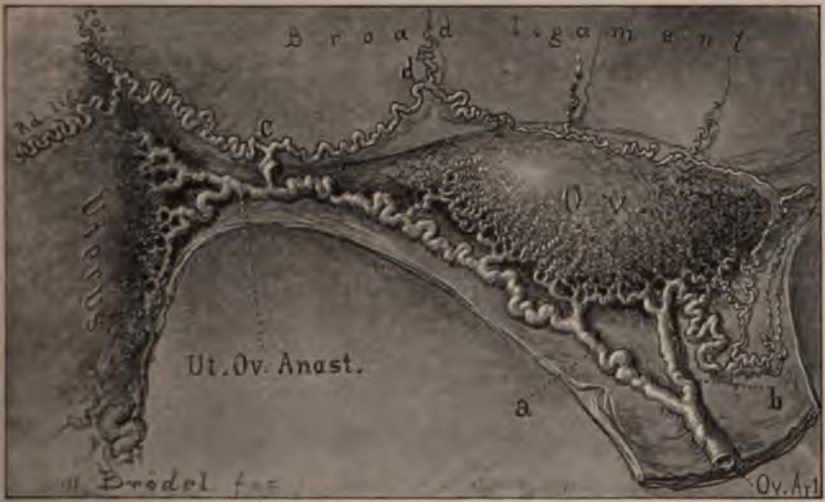


FIG. 30.—THE UTERINE AND OVARIAN VESSELS IN THEIR DISTRIBUTION, SHOWING ALSO THE ANASTOMOSIS UNDER THE UTERINE HORN.

se unite, making two veins; then the common trunk thus formed unites h the third vein to make but one on the surface of the psoas muscle. This laver was injected before dissection, which explains the great distention of veins.

Fig. 29 shows a bird's-eye view of the important vascular trunks of the rus on the left side, from the standpoint of the operator. The uterus is wn drawn strongly upward and to the right. The ureter is seen below eath the uterine artery and one vein; most of the veins pass beneath the ter; the bladder has been opened to show the point of entrance of the left ter. The normal appearance of the internal urethral orifice is well shown. e arteries of the pelvis are exhibited from the bifurcation of the common c artery into the external and internal iliacs, with the division of the innal trunk into its anterior and posterior branches. The uterine artery and superior vesical arise from the anterior trunk which terminates in the



31.—THE UTERO-OVARIAN ANASTOMOSIS SHOWN MORE EXACTLY IN THE ABSENCE OF THE VEINS. THE HORIZONTAL VESSEL ABOVE GIVES OFF THE BRANCHES TO THE UTERINE TUBE AND THE ROUND LIGAMENT.

pogastric artery. The origin of the vaginal artery in this case is from the pogastric, instead of from the uterine trunk. The ureter lies somewhat ser to the cervix uteri on the left side.

Fig. 30 is taken from an injected pelvis of a fully developed multipara, and ws the entire vascular relations of the uterus, ovary, and uterine tube, as n from the front. The anterior leaf of the peritoneum has been removed, ving the vessels *in situ,* and held in place by the posterior leaf.

The relations of the uterine vessels to the ureter, the cervix, and the vaginal lt should be carefully noted. The ureter lies below the uterine artery and of its veins (as a rule but one), and above a plexus of uterine and vaginal veins. The uterine artery ascends beside the uterus, from 1 to 2 or 3 mm. away from it; it is tortuous and interwoven with its veins. At the neck of the uterus, opposite the internal os, it gives off a large artery which penetrates the uterine body; all the other branches which go to the uterus are small. Up near the cornu uteri the terminal branch of the uterine artery anastomoses with a branch of the ovarian artery.

The ovarian artery enters the pelvis in the suspensory ligament of the ovary (infundibulo-pelvic ligament); it divides just before it reaches the hilum of the ovary into two branches, *a* and *b*; the main branch continues on in its course toward the cornu uteri, giving off numerous small vessels into the ovarian hilum; on reaching the utero-ovarian ligament, it penetrates it and passes through its substance until it reaches the side of the uterus, where it anastomoses with the uterine artery. In its course in the utero-ovarian ligament the ovarian artery gives off a secondary branch, *c*, which pierces the ligament about 1 cm. from the uterus, and divides into two other branches going in opposite directions, one to supply the round ligament, and the other running along the base of the mesosalpinx parallel to the tube and anastomosing with the vessels of the first branch of the ovarian artery. The horizontal vessel formed by this anastomosis gives off from four to six ascending straight branches, which traverse the mesosalpinx to the mesenteric attachment of the tube. These branches run out under the tube and form a series of loops by anastomosis.

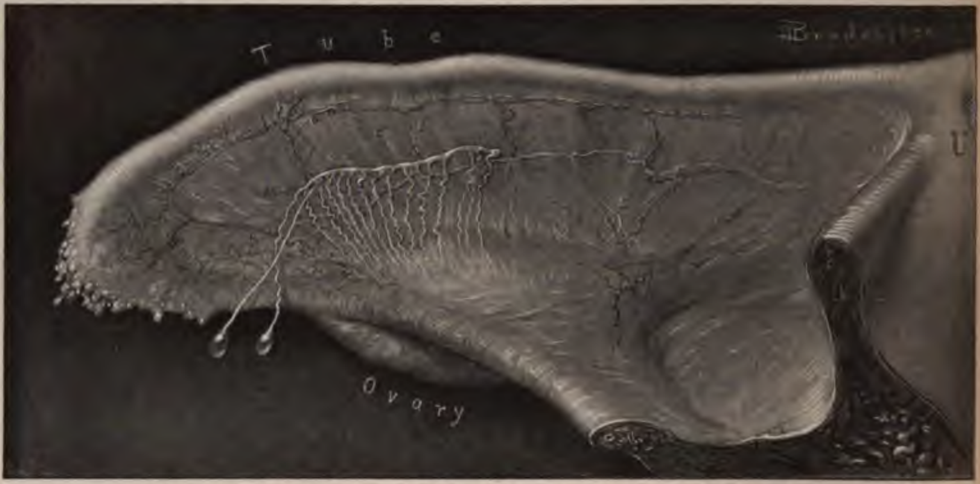


FIG. 32.—THE PAROVARIUM IN A GIRL OF NINETEEN. THE OVARY, WHICH LIES BEHIND THE MESOSALPINX, IS SEEN HANGING DOWN BELOW.

Fig. 31 shows in accurate detail the ovarian artery as it reaches the utero-ovarian ligament and divides into a uterine branch and a short trunk, which pierces the ligament to give off the round ligament artery and the horizontal tubal branch.

Fig. 32 shows the parovarium of a girl nineteen years old. The uterine tube is quite delicate. The ovary is only partially seen, because it lies behind the broad ligament, which is viewed from the front. The attachment of the hilum of the ovary is, however, indicated by the shaded area. The delicacy of the blood vessels is striking. The tubules of the parovarium are well shown, lying in the mesosalpinx situated about halfway between the tube and the ovary; the Wolffian duct is seen running parallel to the tube and giving off about fifteen vertical tubules converging toward the hilum of the ovary. Some of the outer tubules are beautifully convoluted. The outer extremity of the Wolffian duct terminates in two so-called hydatids, hanging free by a little pedicle from the front of the broad ligament across the tubo-ovarian fimbria.

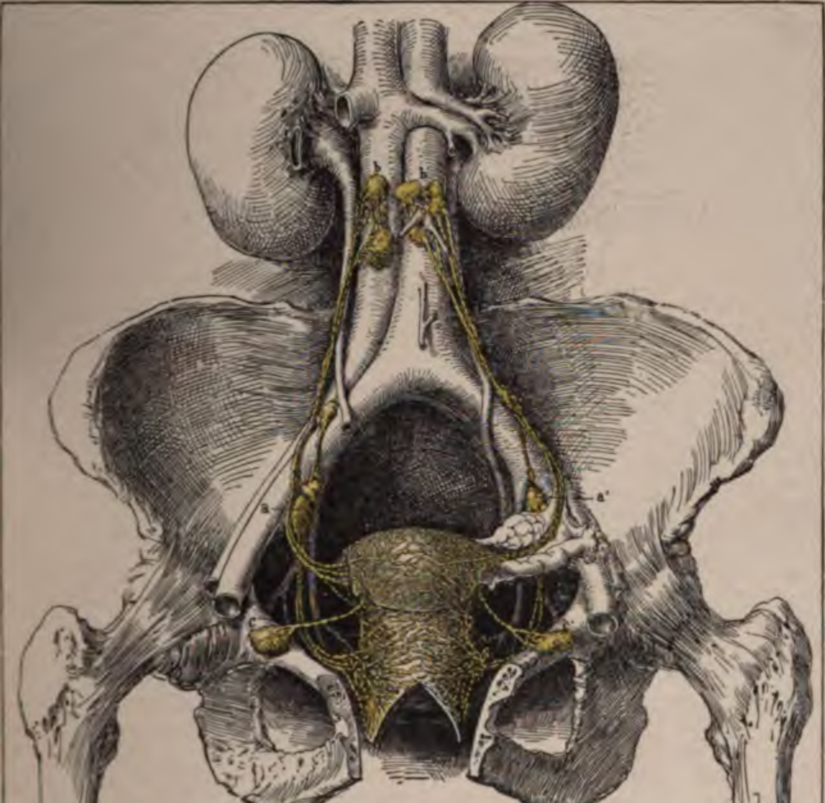


FIG. 33.—THE LYMPHATIC SYSTEM OF THE PELVIS AND ITS COMMUNICATIONS WITH THE PELVIC AND ABDOMINAL LYMPHATICS, AND, THROUGH THE ROUND LIGAMENTS, WITH THE GLANDS UNDER THE CRURAL ARCH.

Fig. 33. Lymphatic system of pelvic organs.—The uterus with its appendages, and the vagina are everywhere covered by a rich network of lymphatic vessels, with whose anatomical arrangement we have become acquainted

through the observations of Mascagni and Poirier. This vascular network surrounds the uterus and vagina like the finest lace. Upon leaving the uterus, the smaller vessels collect into larger trunks, which then discharge into the various

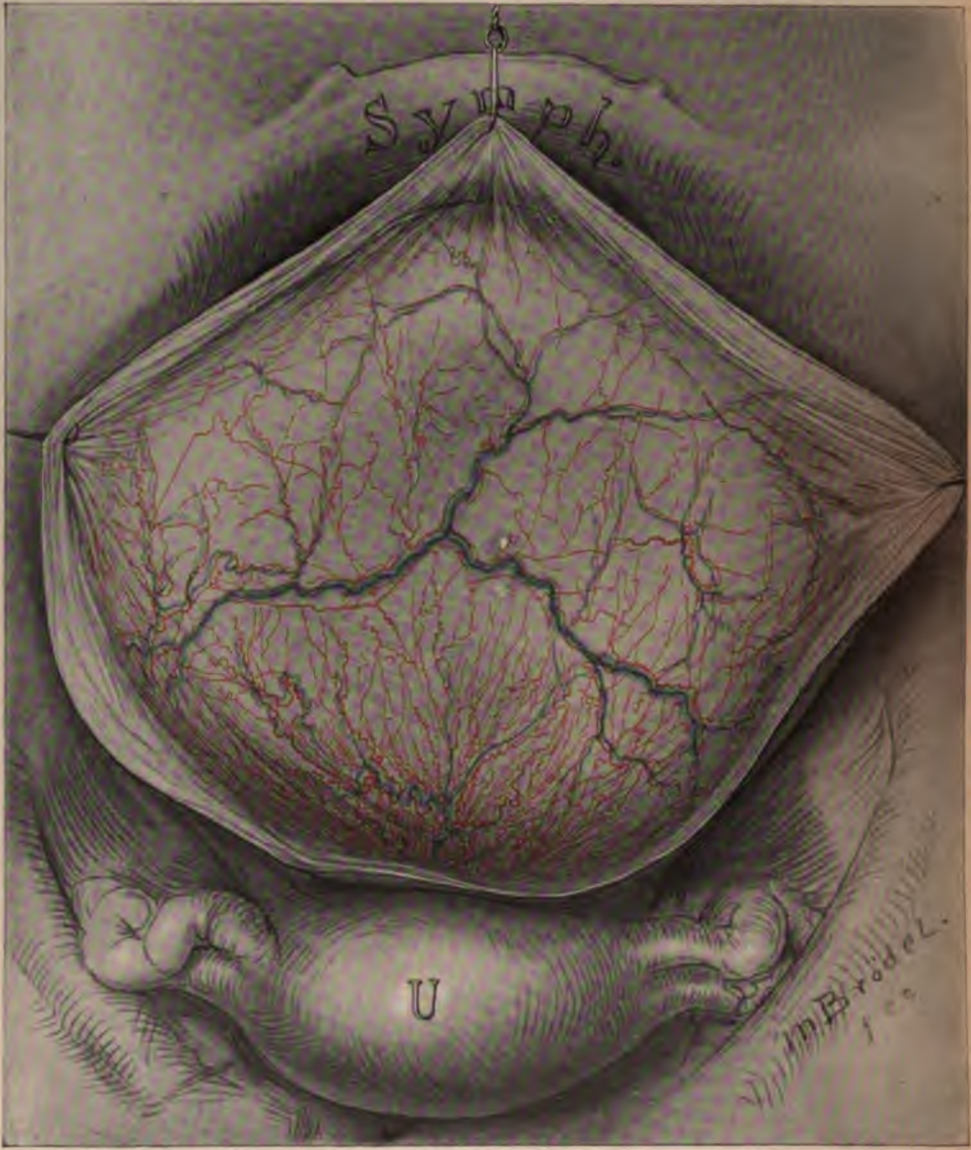


FIG. 34.—THE VASCULARIZATION OF THE VAULT OF THE BLADDER IN ITS PERITONEAL PORTION.

neighboring glands. From the upper part of the vagina and lower cervix the lymph vessels collect to enter the glands on the pelvic floor and accompany the uterine and internal iliac vessels, to the next system of glands, in the bifurcation of the common iliac arteries (a a′). From this point the lymph channel leads over the artery to a gland often found on its upper side, well above the bifurcation, and so on up to the lumbar glands (b b′). The lymph vessels of the body of the uterus either pass out through the mesosalpinx near the ovarian attachment, and on up the suspensory ligament of the ovary to the lumbar glands (b b′), or take quite another direction and course down the round ligaments to the deep inguinal glands (c c′). The lowest part of the vagina and external genitals are richly supplied with lymphatics, which communicate with the superficial and deep inguinal glands, and through these with the glands lying upon the external iliac arteries.

Fig. 34 gives a good idea of the vascularization of the vault of the bladder —that part of the bladder which is in relation to the peritoneum. The peritoneum has been dissected off to show the circulation. The veins are seen anastomosing across from one side to the other, and terminating below in the urethrovesical plexus at the neck of the urethra. The superior vesical arteries are also

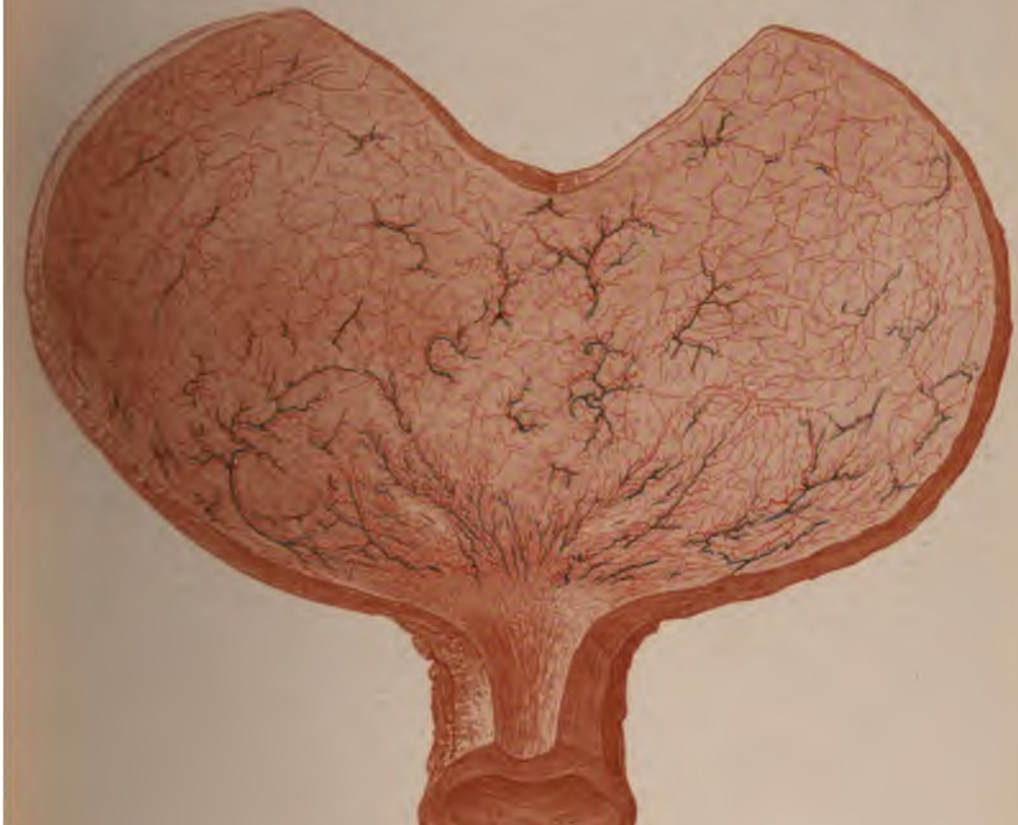


FIG. 35.—THE VASCULARIZATION OF THE VESICAL MUCOSA AS SEEN THROUGH THE CYSTOSCOPE.

seen. It is important to note the unusual injection in the neighborhood of the cervix uteri.

Figs. 35 and 36 show the vascularization of the vesical mucosa, and exhibit beautifully the dendritic arrangement of the little branches of the superior, middle, and inferior vesical vessels as they plunge through the coats of the bladder and come to view on the mucous surface, branching out into small vessels and capillaries. It will be seen that certain definite areas of the bladder are constantly vascularized by the same groups of vessels.

The first great group is at the trigonal area (*c*) where the vessels branch out into the bladder from the internal urethral orifice like a fan, appearing at the upper edges of the papillæ and coursing toward the ureteral orifices; they then continue parallel to the ureteral folds, and so reach the side walls of the bladder.

This group of vessels anastomoses with the next (*a*), which is seen just below the edges of the cut; the second group is derived from the superior vesical vessels, and several vascular trees are seen coming through to the surface of the mucosa and distributing themselves over it in fine branches. In the posterior part of the bladder the middle vesical vessels occupy the area in the neighborhood of the cervix uteri (*b*); vascular trees from this source on the right and on the left side are quite constantly found, and form a characteristic landmark in the examination of the living subject through the speculum.

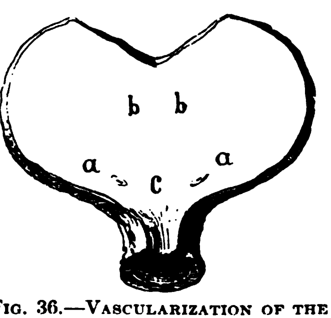


Fig. 36.—Vascularization of the Vesical Mucosa by the Right and Left Superior, Middle, and Inferior Vesical Arteries.

The superior vesical arteries (*a*) are distributed over the superior and lateral regions of the bladder. The middle vesical arteries (*b*) are distributed over the posterior portion, which lies in relation to the uterus and upper vagina. The inferior vesical arteries (*c*) are distributed to the trigonum and the middle part of the vagina.

Fig. 37 shows the topography of the fixed part of the bladder—that part which is attached to the symphysis pubis, vagina, and cervix uteri, as contrasted with the upper movable peritoneal portion. The first striking feature is the hexagonal form, which is caused by the attachment of the bladder to the symphysis and its angular reflection out over the lateral pubic rami. From the posterior point of attachment to the pubic rami it is reflected again at an angle to its cervical attachment, which it also meets at an angle, completing the hexagon. The trigonum is well shown and the internal urethral orifice lies a little in advance of the center, forming a transverse fold with a sharp ridge above it, and with numerous fine radiating folds entering the opening from below. The ureteral orifices are about 2½ cm. apart, and the same distance from the urethra; each orifice is situated on a little mons ureteris. The inter-ureteric ligament is evident by a slight elevation. Posterior to the inter-ureteric ligament is that part of the base of the bladder which lies in relation to the upper vagina.

Fig. 38 is a sagittal section of the pelvis, showing the rectum drawn away from the sacrum, in order to demonstrate the arteries, veins, and nerves of the sacral and lateral pelvic regions. The distribution of the superior hemorrhoidal vessels is also seen. The sacral plexus of nerves is seen to emerge from the sacral foramina, forming the lumbo-sacral cord, and the first, second,

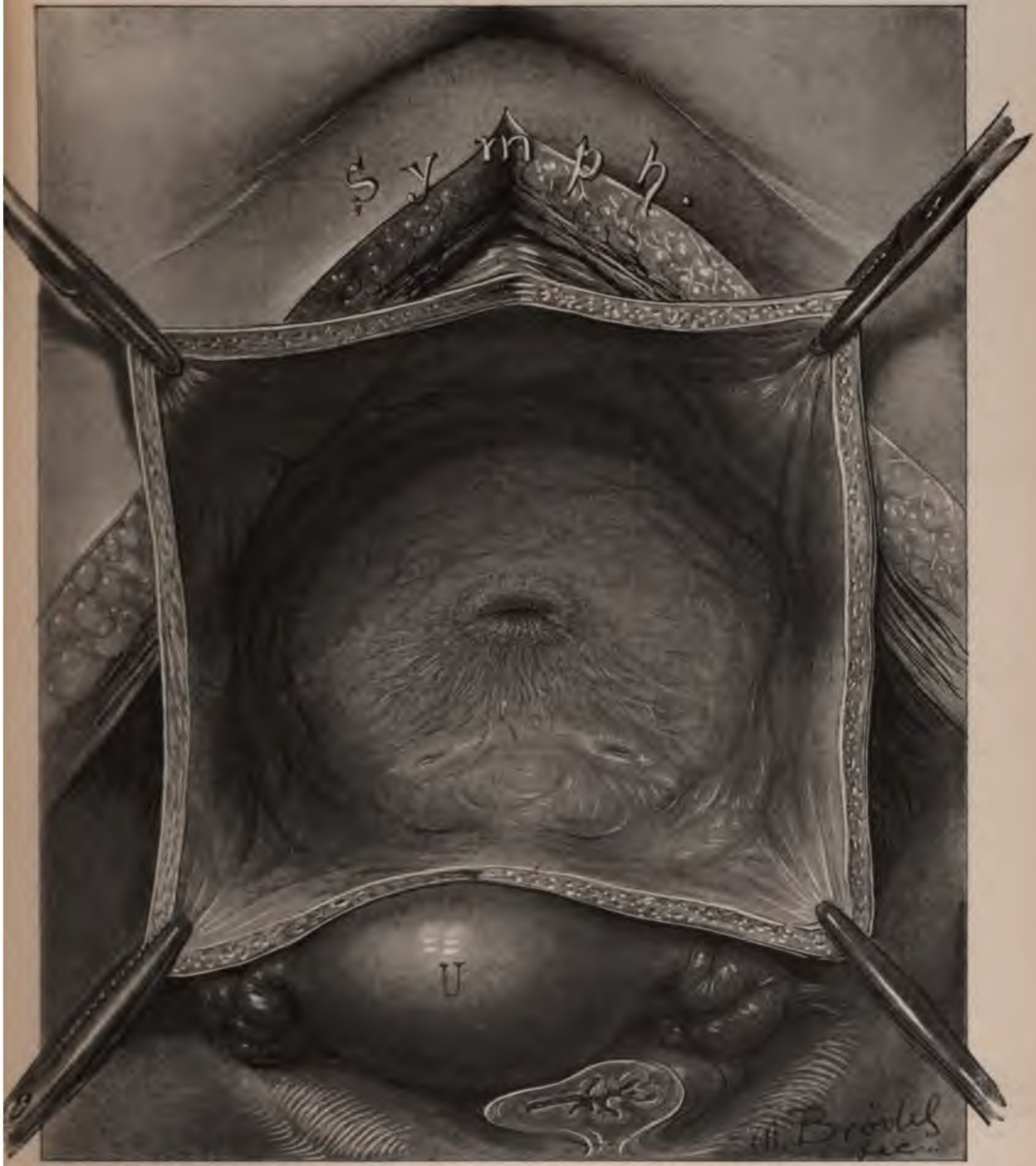


FIG. 37.—THE TOPOGRAPHY OF THE FIXED PART OF THE BLADDER. THE VESICAL CORNUA LIE TO THE RIGHT AND LEFT OF THE URETERAL ORIFICES, JUST IN FRONT OF THE BROAD LIGAMENTS.

third, fourth, and fifth sacral cords, which converge toward the great sacro-sciatic foramen, to unite in the sciatic nerve. The sacral ganglia of the sympathetic nerve are seen lying upon these nerves as they emerge from the foramen. Observe the nerves going from the fourth sacral cord to the lower part of the rectum and the coccygeus muscle.

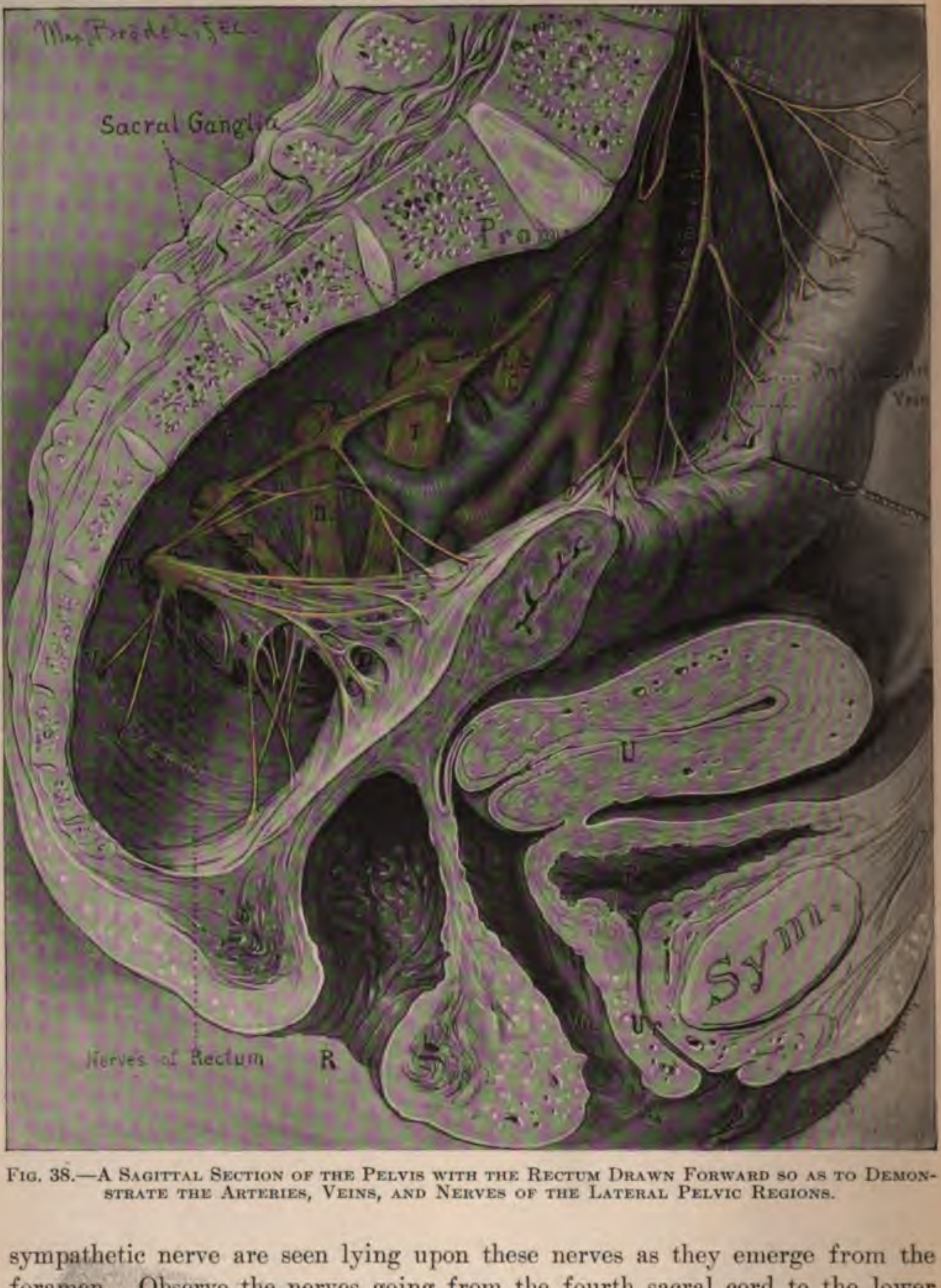


FIG. 38.—A SAGITTAL SECTION OF THE PELVIS WITH THE RECTUM DRAWN FORWARD SO AS TO DEMONSTRATE THE ARTERIES, VEINS, AND NERVES OF THE LATERAL PELVIC REGIONS.

Fig. 39 shows the **muscles of the pelvis** in sagittal section with arteries and erves, after removal of the viscera. The psoas muscle is seen overhanging he brim of the pelvis and narrowing its superior strait; upon the psoas lie the ommon and external iliac arteries, and it is crossed by the internal iliac artery. he obturator muscle covers the obturator foramen, and its fibers converge

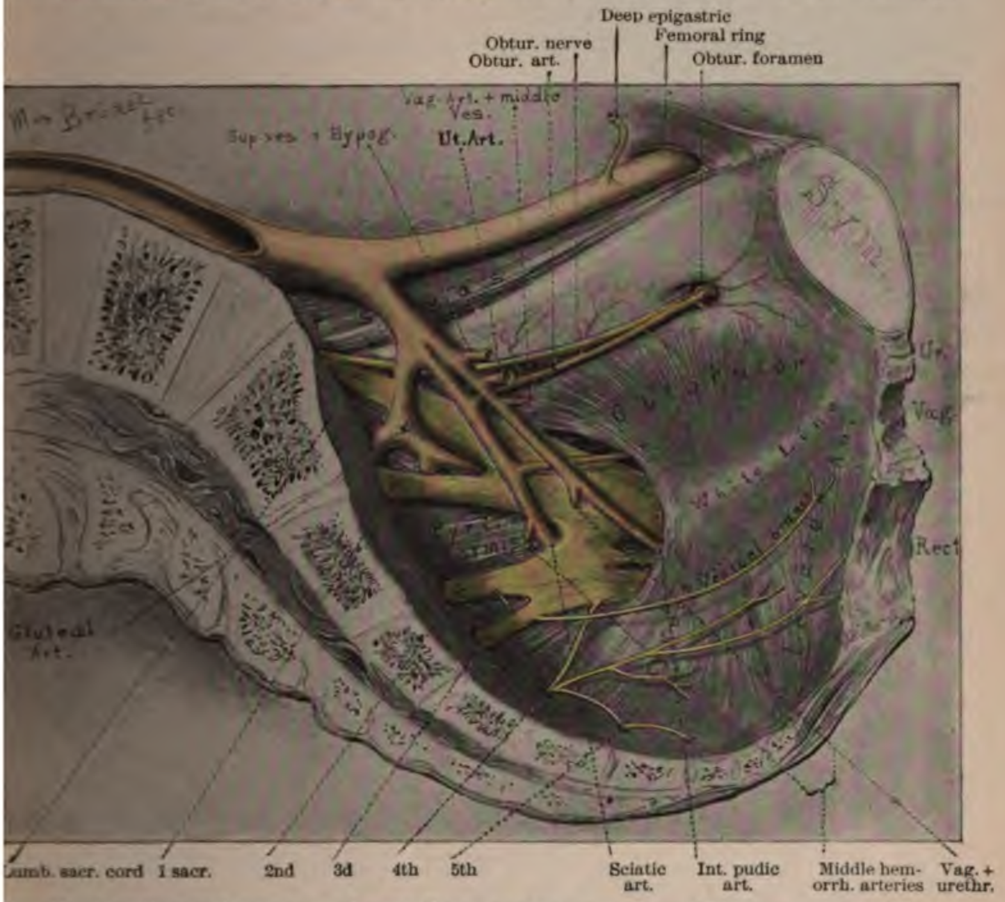


FIG. 39.—THE SACRAL NERVES, THE LOWER ROOTS OF WHICH ARE EASILY PALPATED BY THE RECTUM.

to its tendon, which passes out of the pelvis through the lesser sciatic notch. At the lower margin of the obturator muscle is the white line of fascia which marks the upper border of the levator ani muscle. The levator ani seen arising from the fibrous line will be described more particularly in connection with Figs. 45 to 48. The coccygeus muscle borders the posterior margin of the levator ani, is fan-shaped, and is attached by its base to the side of the lower sacrum and coccyx, and by its apex to the spine of the ischium. The pyriformis muscle pads the posterior part of the pelvis, rising in muscular bundles from the front of the sacrum and gradually converging and passing out of the pelvis through the great sacro-sciatic foramen, posterior to the sciatic nerve.

The sacral plexus forming the sciatic nerve is seen as in Fig. 38. The obturator nerve courses around the pelvic wall parallel to and below the brim of the pelvis to the obturator foramen, where it leaves the pelvis. The vesical branch from the third sacral cord is shown, and the nerves from the fourth sacral cord going to the rectum, levator ani, and coccygeus.

Fig. 40 shows the internal inguinal and femoral rings and the round ligament, as viewed from within the body. Poupart's ligament divides the inguinal ring above, from the femoral ring below. The external iliac artery and vein pass out of the pelvis under Poupart's ligament, and give off the deep epigastric vessels which course up to the under surface of the abdominal wall around the inside of the internal inguinal ring. The epigastric artery courses in an

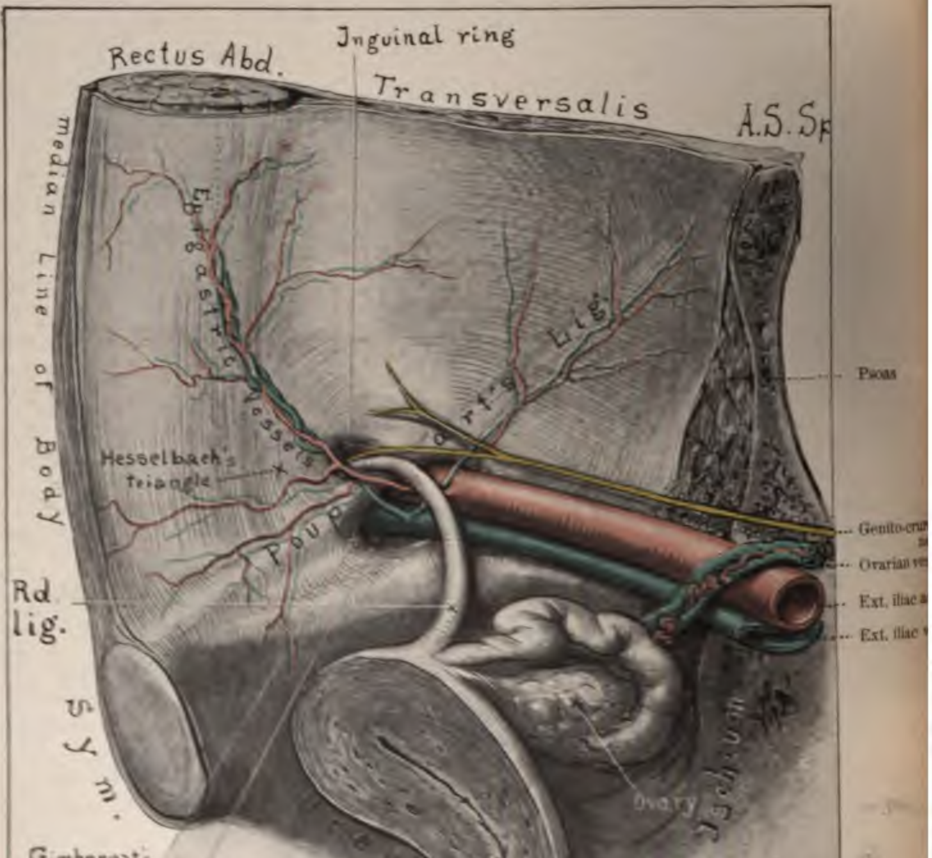


FIG. 40.—THE INTERNAL INGUINAL AND FEMORAL RINGS. THE ROUND LIGAMENT IS SEEN PASSING OUT OF THE INGUINAL CANAL.

oblique direction to the rectus muscle, whose outer border it follows beneath the transversalis fascia for about 5 cm., when it pierces the rectus and lies well inside the semilunar line. Hesselbach's triangle lies between Poupart's ligament, the outer border of the rectus, and the epigastric vessels. The round ligament crosses and lies upon all these important vessels in its terminal portion in the abdominal cavity.

Fig. 41 shows the pelvic viscera and the round ligaments from above. The directions of the round ligaments and the exact angles they make with the uterus and abdominal wall are accurately drawn, in order to demonstrate the mechanical effects of traction made upon the ligaments at the internal inguinal ring; it is evident that the ligaments have more of a lifting effect upon the uterus, and do not serve to bring it forward to any marked extent.

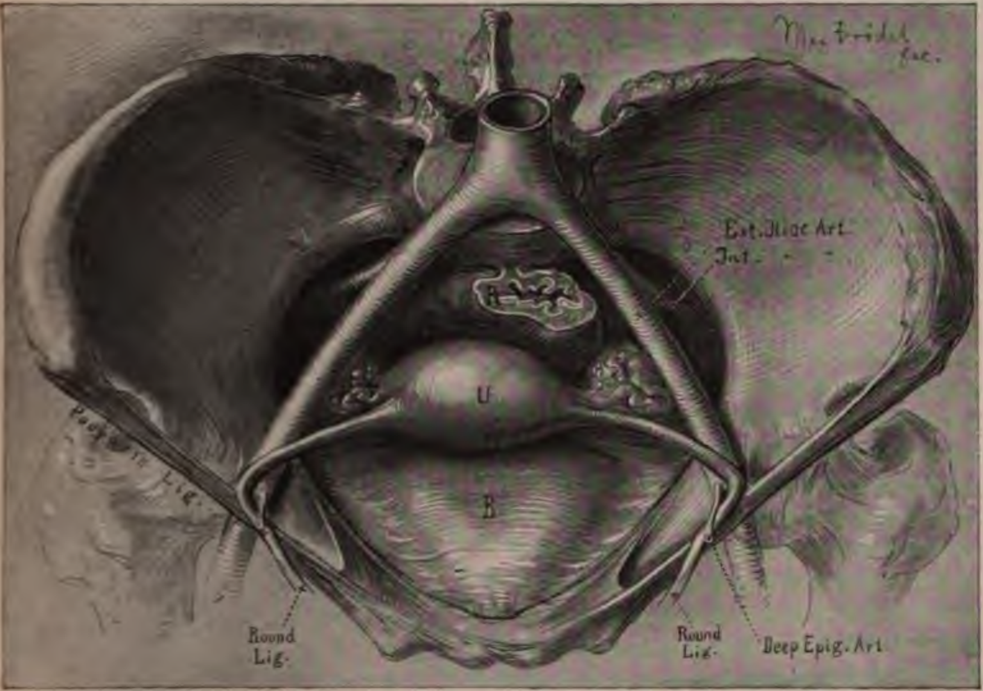


FIG. 41.—THE PELVIC VISCERA AND ROUND LIGAMENTS SEEN FROM ABOVE.

Fig. 42 shows the **pelvic floor** as seen through the superior strait when all the viscera are removed. Note the relations of the three orifices of exit—the urethra, the vagina, and the rectum—in the muscular diaphragm of the pelvic floor, and the relation of these to their surrounding bony supports. The pelvis is funnel-shaped and the orifices disposed in the anterior portion; the urethra appears as a small slit surrounded by thick walls just under the pubic arch. The vagina has the characteristic shape of the letter H lying on its side, and appears embraced by the muscular fibers of the levator ani, which hold the lower part of the rectum forward. The puckered rectal opening is grasped in

sacral plexus forming the sciatic nerve is seen as in Fig. 38. The obtu
e courses around the pelvic wall parallel to and below the brim o
is to the obturator foramen, where it leaves the pelvis. The vesical br
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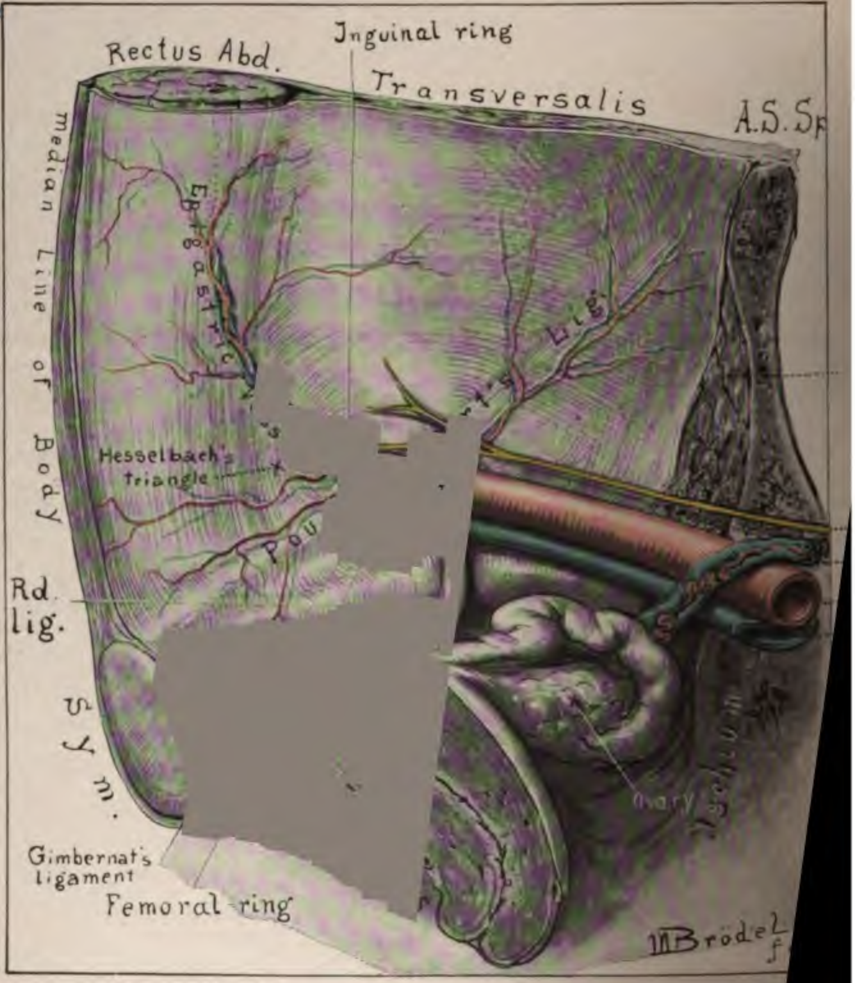


FIG. 40.—THE INTERNAL INGUINAL AND FEMORAL RINGS. THE ROUND LIGAMENT IS S
OUT OF THE INGUINAL CANAL.

ring above, from the femoral ring below. The external iliac
pass out of the pelvis under Poupart's ligament, and giv
tric vessels which course up to the under surface of the
the inside of the internal inguinal ring. The epigast

Within the bony framework of the pelvic outlet, as formed laterally and posteriorly by the great sacro-sciatic ligaments, are seen the three pelvic outlets—the urethral, vaginal, and anal—corresponding to the same outlets seen from within in the complementary picture (Fig. 42). It is important again to notice the position of the urethra, high up under the pubic arch, with the vagina immediately beneath it; the anal orifice is at about the center of the figure, halfway between the pubic arch and coccyx and the tuberosities of the ischium. A striking feature in the picture is the ischio-rectal fossæ between each tuberosity and the levator ani muscle. Posteriorly the inferior hemorrhoidal arteries are seen emerging from the ischio-rectal fossæ, curving forward, and branching over the levator ani muscle, to be distributed to the lower part of the rectum and the sphincter ani muscle. The superficial perineal arteries are

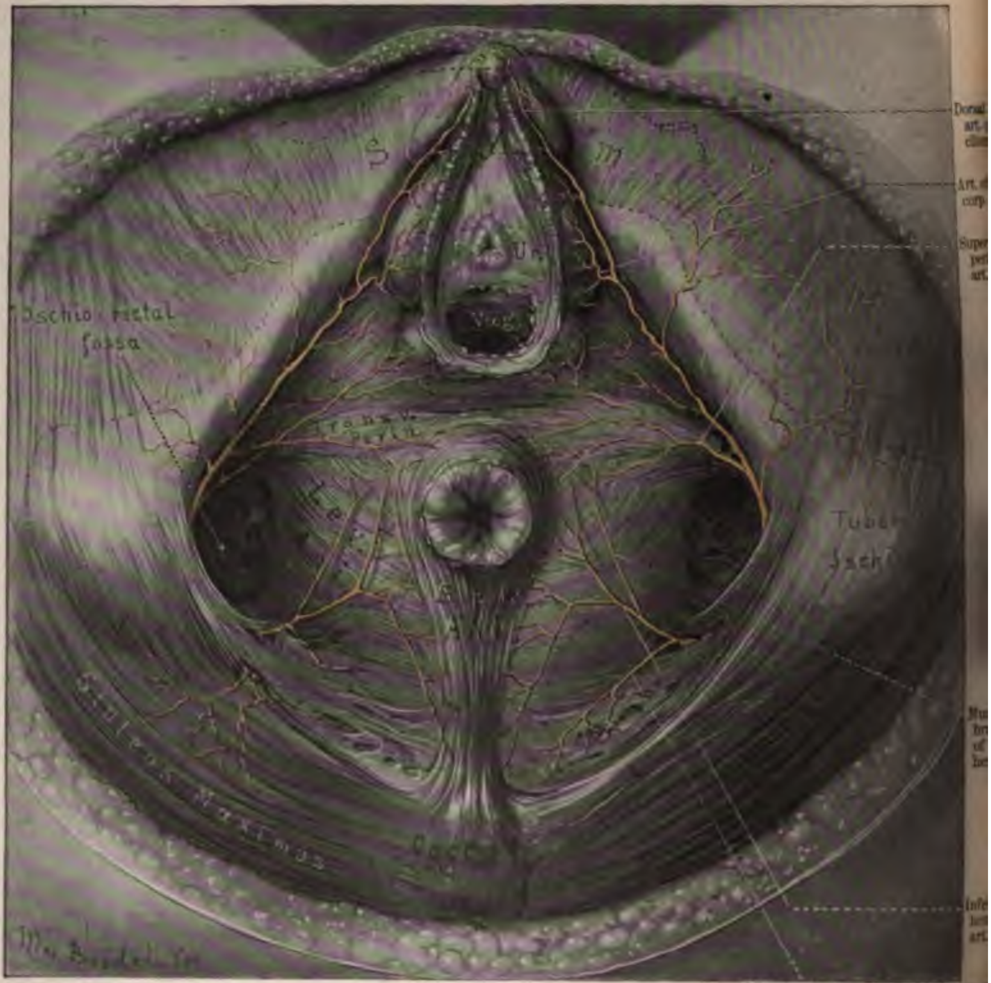
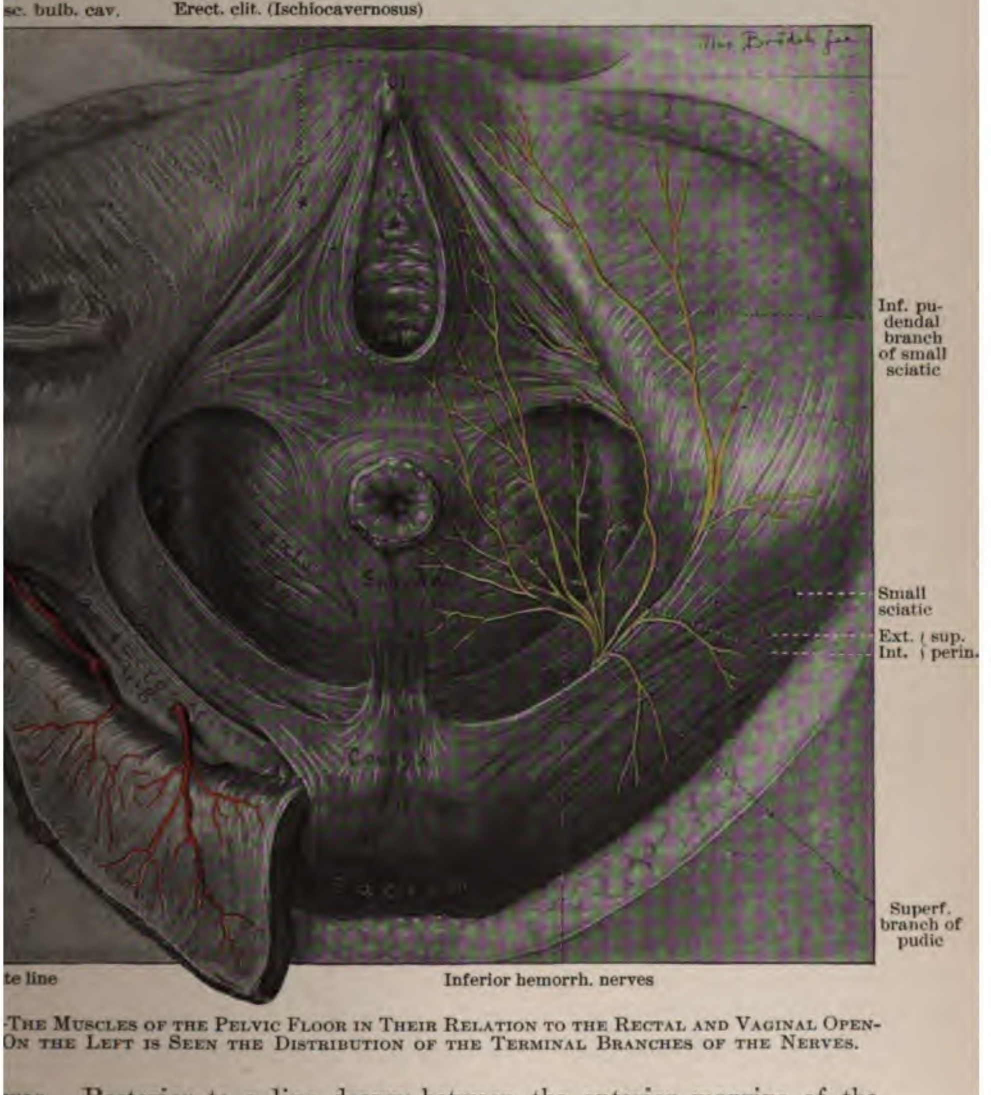


FIG. 44.—THE ARTERIAL VASCULARIZATION OF THE FLOOR OF THE PELVIS AS SEEN FROM WITHOUT.

erging from the depths of the ischio-rectal fossæ anteriorly, and cours- vard in front of the rectum over the transverse perineal muscles. The l branches of the internal pudic artery are seen in their distribution, branch going to Bartholin's gland, a branch above this to the bulb of oris, and the remaining branches supplying the corpora cavernosa and um of the clitoris.

45 shows the muscles of the pelvic floor in their relation to the vaginal al openings, together with the distribution of the terminal branches of



-The Muscles of the Pelvic Floor in Their Relation to the Rectal and Vaginal Open- On the Left is Seen the Distribution of the Terminal Branches of the Nerves.

rves. Posterior to a line drawn between the anterior margins of the ities of the ischium are seen the following muscles. The transverse l muscles take their origin beneath the tuberosities of the ischium and cross the perineal body horizontally between the vaginal outlet and the anal orifice, each one fusing with its fellow on the opposite side. A number of the muscular bundles diverge from the horizontal fibers anteriorly and posteriorly at angles of about 30 degrees, to fuse in front with the constrictor vaginæ, and behind with the sphincter ani and levator.

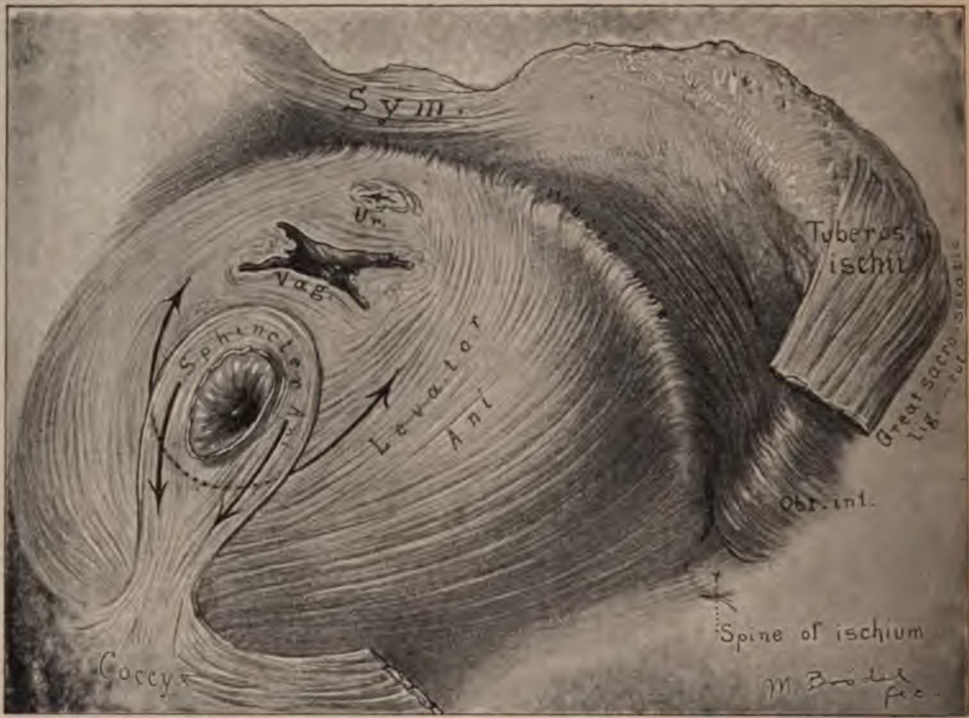


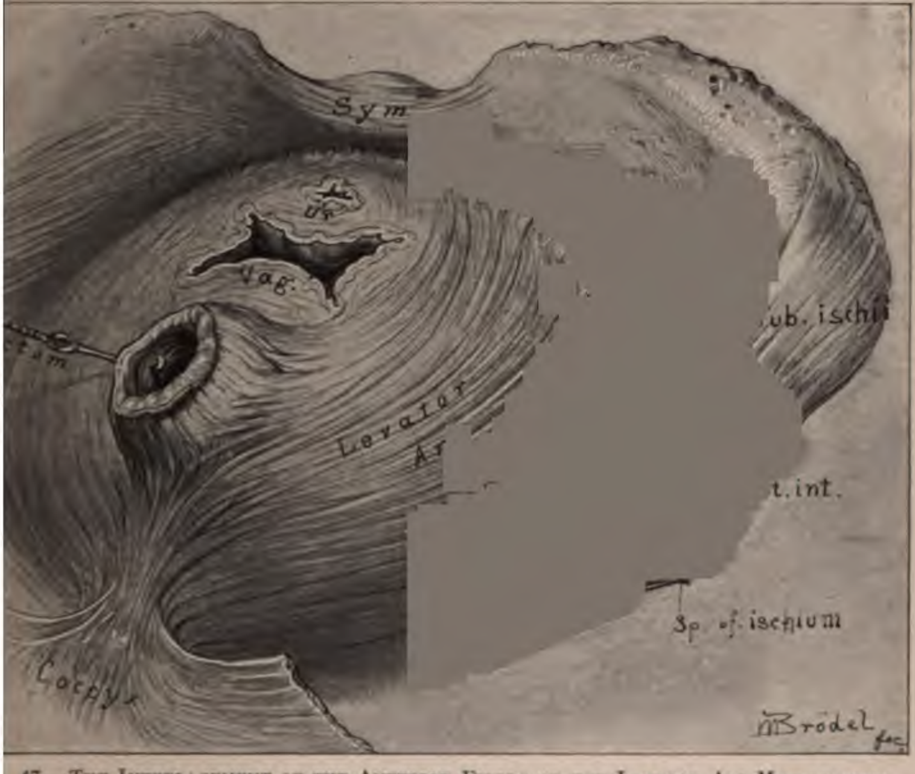
Fig. 46.—Shows the Action of the Levator Ani Muscle in Pulling Up the Lower Portion of the Rectum under the Pubic Rami against the Symphysis, so as Effectively to Close the Vagina, Giving it the Characteristic Shape Shown in the Picture.

The most conspicuous feature in the center of the figure is the roll of muscular fibers surrounding the rectal outlet, and so forming the external sphincter; these fibers posteriorly are seen attached to the end of the coccyx.

The levator ani muscles are seen on each side, filling the space between the sphincter ani and the tuberosities of the ischium. Each levator ani arises high up under the internal surface of the descending pubic ramus, from a white line of fibrous tissue stretching from the internal surface of the pubic ramus to the spine of the ischium. The anterior portion of the levator ani muscles can not be seen in this drawing, but a portion of the white fibrous line is well shown. Between this line and the tuberosity of the ischium a portion of the obturator internus muscle is visible. The coccygeus muscle, which appears almost as a continuation of the levator ani posteriorly, is seen filling out the space between the levator and the great sacro-sciatic ligaments. In the anterior half of the picture, lying in front of the transverse perineal muscles, are shown the con-

or vaginæ or bulbo-cavernosus made up of a few delicate muscular fibers, acing the vaginal outlet. External to the constrictor vaginæ or the bulbo-nosus lies the erector clitoridis muscle, arising from the pubic arch pos-rly, and converging toward its fellow on toward the dorsum of the clitoris. he right side of the picture are shown the internal pudic nerve and the ior pudendal nerve. The various branches of the internal pudic nerve, ar in name and distribution to the corresponding arteries as described in 44, are seen in their distribution to the muscles of the pelvic floor, eum, and vaginal outlet.

'ig. 46 shows the origin and insertion of the fibers of the levator ani muscle, en from below. The sphincter ani, the lower part of the vagina, and the mity of the urethra have been cut off on a level with the attachments of muscle. Important landmarks are the symphysis, coccyx, and the left



. 47.—THE INTERLACEMENT OF THE ANTERIOR FIBERS OF THE LAVATOR ANI MUSCLE WITH THOSE OF THE INTERNAL SPHINCTER MUSCLE OF THE RECTUM.

rosity of the ischium. Just inside the tuber ischii the fibers of the internal rator muscle are seen arising from the inner surface of the obturator men and the adjacent pubic ramus and converging to the tendon, which s out of the lesser sacro-sciatic foramen. The great sacro-sciatic ligament been cut away in order to expose the levator ani muscle in its entirety.

The line of origin of the levator ani is well shown, stretching from the inner surface of the pubic arch, about 3 mm. below its horizontal portion, and back in a gently curved line to the spine of the ischium. The direction of the fibers of this muscle change from the anterior to the posterior part to such an extent that the fibers from the pubic arch form almost a right angle with the posterior fibers.

Owing to the direction of the anterior fibers, and their insertion into the fibrous tissues of the perineum and the sides of the rectum, they have a lifting power upon these structures which is efficient in closing the vaginal outlet. It is important to note the blending of the levator ani muscle with the external longitudinal fibers of the rectum (see Fig. 47).

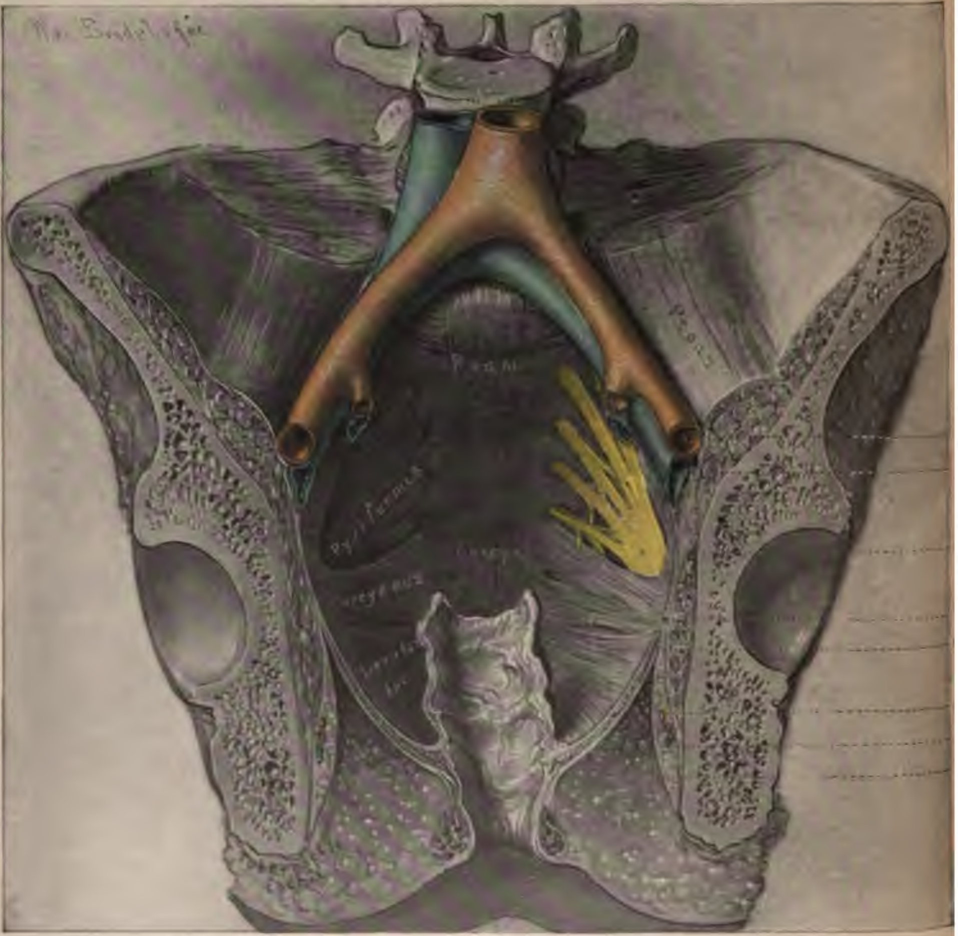


FIG. 48.—A CORONAL SECTION OF THE PELVIS TO SHOW THE LEVATOR ANI MUSCLE AND THE POSTERIOR MUSCLES OF THE PELVIS.

Fig. 48 is a coronal section of the pelvis through the iliac crests, the acetabula, and the tuberosities of the ischium, showing the posterior part of the lvis and the levator ani muscles and rectum in vertical section. The thin af-like nature of the muscle is well shown. The funnel shape of the posterior art of the levator, extending from the spine of the ischium to the coccyx, is rought out. The broader surface of attachment is also shown, blending with he longitudinal muscular fibers of the rectum and with the sphincter ani uscle. The division of the fascia ensheathing the obturator internus at the oint called "the white line" is shown. The obturator internus appears in ection between the levator ani and the ischium, and in the depths of the ischio-ctal fossa, below the levator, appear the pudic vessels and nerves lying close to e tuberosity of the ischium. The coccygeus and pyriformis muscles appear continuations of the levator, parallel to its upper fibers and clothing the sterior pelvic walls on both sides of the sacrum. The sacral plexus is seen rlying the pyriformis muscle on the left.

CHAPTER V.

THE GYNECOLOGICAL EXAMINATION.

1. The gynecological examination (p. 84): Inspection. Measurements. Photography. The normal abdomen. Abdomen of ovarian cyst. Abdomen of fibroid tumors of the uterus. Ascitic abdomen. The use of specula in inspection. Percussion. Auscultation. Palpation. Postures employed (p. 95): Standing. Squatting or crouching. Sitting and bending forward. The left lateral, or Sims' posture. The knee-chest. The dorsal. Measuring resistances. Examination of the pelvic organs in the dorsal position (p. 101): Simple examination with one hand in vagina or rectum. The bimanual examination with the organs in *situ*, or with invagination of the pelvic floor. Examination of the uterus. Examination of the ovaries. Examination of the uterine tubes. Bimanual examination by the rectum and abdominal walls. Bimanual examination by rectum and abdomen after atmospheric distention of the rectum. Bimanual examination in the dorsal position with elevated pelvis; the same with the uterus in artificial retroposition. The bimanual examination with the uterus drawn down to the vaginal outlet. Examination of the anterior surface of the uterus through the rectum. Examination in pelvic disease (p. 109): Pelvimetry, four ways of measuring the true conjugate diameter. Seat of pain. Anesthesia. Rules for use of anesthesia. Preparation of patient. The examination. Displacements affecting position. Descensus. Anteflexion. Retropositions. Ascensus uteri. Fixations and adhesions affecting mobility. Inflammation and tumors affecting size and form. Peculiarities of sensitiveness. Peculiarities of consistency. Information derived from curettage of the uterus. Microscopic examination of a piece of tissue excised. Microscopic and bacteriological examination of uterine, vaginal, and other discharges. Examination of the rectum. Examination of the vermiform appendix.
2. The general examination (p. 127): Age. Heredity. Temperament. Habit. Color. Diseases to look out for. Lung disease. Affections of the heart and arteries. Affections of the alimentary canal. Diseases of the liver. Diseases of the kidney. Taking the history. Skeleton outlines of history and treatment. Diagrams of pelvic lesions. Minute examinations of gynecological cases.

THE recent progress in gynecology is chiefly due to the new and better methods of examining patients, which constitute a fundamental difference between the gynecology of to-day and that of our immediate predecessors.

The gynecological examination includes both an investigation of any existing pelvic disorders and a careful inquiry into the patient's general condition. The natural order of inquiry is first to take the history, then to examine the pelvic organs, and finally to make the general examination.

EXAMINATION OF THE ABDOMINAL ORGANS.

The examination proceeds by making an orderly investigation of the pelvic and abdominal organs by means of inspection, palpation, percussion, and auscultation.

Inspection.—Inspection is limited to the surface of the abdomen, the external genitals, and those parts of the rectum, vagina, and cervix which can be exposed to view, either directly or by instrumental aid. In doubtful cases inspection may even go so far as to make a direct examination of the uterus, ovaries, and tubes through an exploratory incision in the abdominal wall.

The general condition of the body—whether fat, well nourished, or emaciated—is naturally the first point to attract attention. Inspection also notes peculiarities of color affecting the skin and the mucous membranes. The greenish-yellow hue of the chlorotic woman will often at once explain an amenorrhea; the cachexia of a cancerous patient is characteristic and easy to remember when once seen; the ovarian facies bespeaks malnutrition, and the pallor of hemorrhage in myomata or extra-uterine pregnancy is a diagnostic factor of the highest importance. The septic patient has a peculiar, sallow, anemic appearance. Inspection also notes the face indicative of hysteria. The careful, slow gait of the patient with pelvic peritonitis, and also any peculiarities in the way of protecting tender parts from touch or shock by pressure with the hands are also to be noted.

Inspection of the abdomen is of the greatest value when the eye is trained to know its various contours in health. Variations between the normal and abnormal contour of the abdomen produced by the growth of tumors, by ascitic effusions, or by gas, can be readily seen. In abdominal tumors the inspection is limited to outlines, and is only one diagnostic measure, which, in association with other aids, enables us to arrive at a correct estimate of the character of the disease beneath.

While a simple inspection is sufficient for the immediate purpose of the diagnosis, careful measurements of abdominal enlargements should always be made and recorded. By means of measurements at different times, changes in the size of a distended abdomen are made evident, and imperceptible differences of a few centimeters can be accurately determined. Besides, we also do away with such vague terms as "a small tumor," "a large," or an "enormous one," eliminating the large personal equation lurking in these statements.

The following are the usual measurements made:

Circumference of the abdomen at the umbilicus.
Circumference halfway below the umbilicus.
Elevation of highest point of abdominal wall above the plane of the anterior-superior spines.
Distance from sternal notch to symphysis pubis.
Distance from umbilicus to pubis.
Distance from umbilicus to right and left anterior-superior spines respectively.

By such measurements the degree and form of abdominal enlargements are determined, whether more in the lower, or in the upper abdomen, or in one flank, and whether symmetrical or asymmetrical.

Photography is a valuable adjunct to descriptive records; the photograph gives an instantaneous idea of form, often better than an elaborate description. The photograph with the patient lying on the table can be taken with advantage from three points of view: A profile from the side, showing the general enlargement of the abdomen; a profile from below, showing symmetry or asymmetry; while a quartering view, halfway between these two positions and looking rather down on to the abdomen gives a general view of the relations of the parts of the tumor to the abdominal landmarks. When possible, the umbilicus should be included in the picture, as the most important

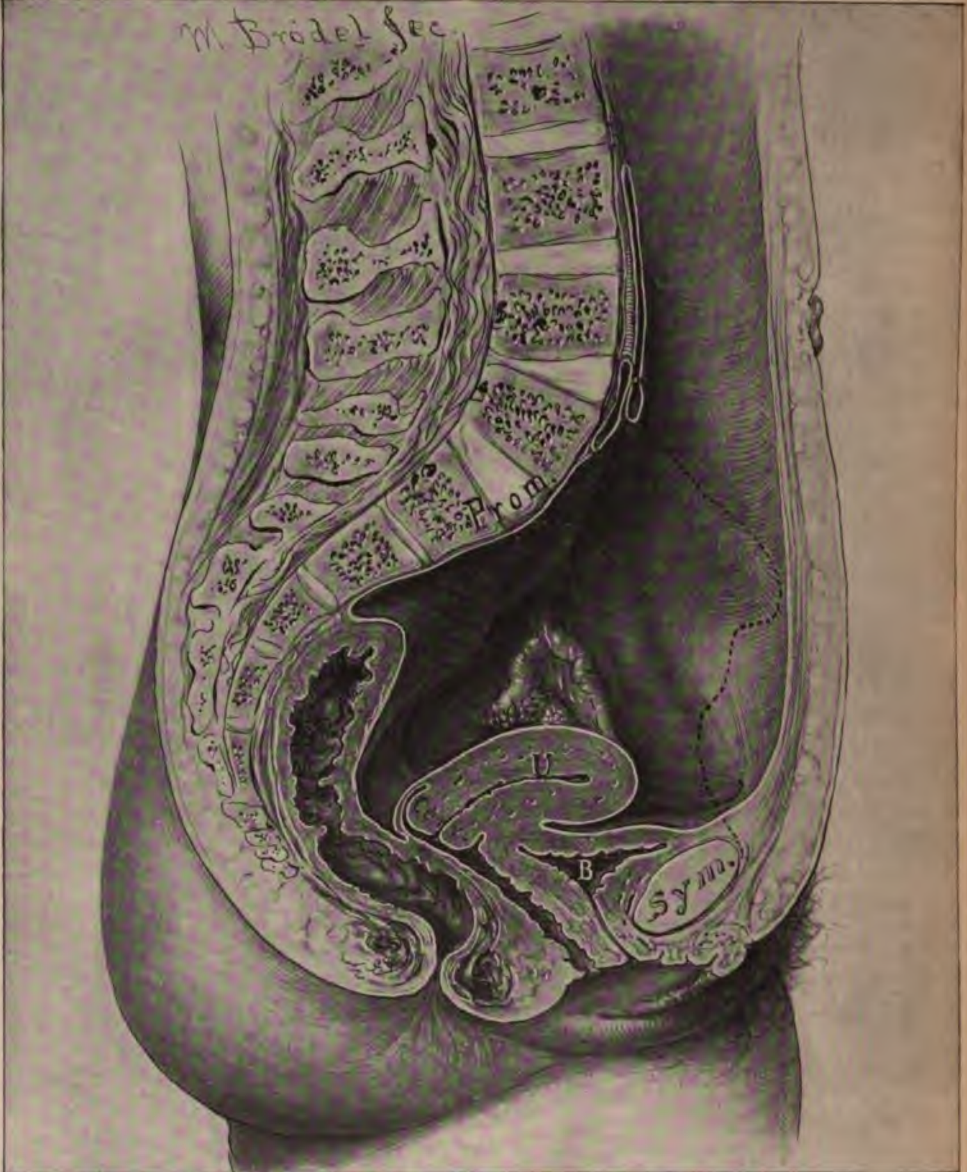


FIG. 49.—SAGITTAL SECTION THROUGH ADULT BODY, SHOWING THE NORMAL POSITION AND RELATIONS OF THE UTERUS, BLADDER, RECTUM, AND ABDOMINAL WALLS.

The intestines are not shown, and the dotted line represents the outline of the pelvic bones. It is important to note the proximity of the anterior abdominal wall to the sacral promontory.

landmark. A profile view, with the patient erect, shows the anterior displacement of a large tumor.

Marked departures from the normal may occur within the limits of health, of which the most frequent are distention from tympany or the accumulation of fat in the omentum and abdominal walls. Tympany produces a symmetrical form, by the uniform expansion of the intestines in all directions, the greatest prominence being around the umbilicus. The general appearance of such an enlargement may not differ at all from that of an encysted tumor. In a fatty abdomen, if the fat is in the walls, it is often characterized by the presence of creases from side to side; if it is inside the

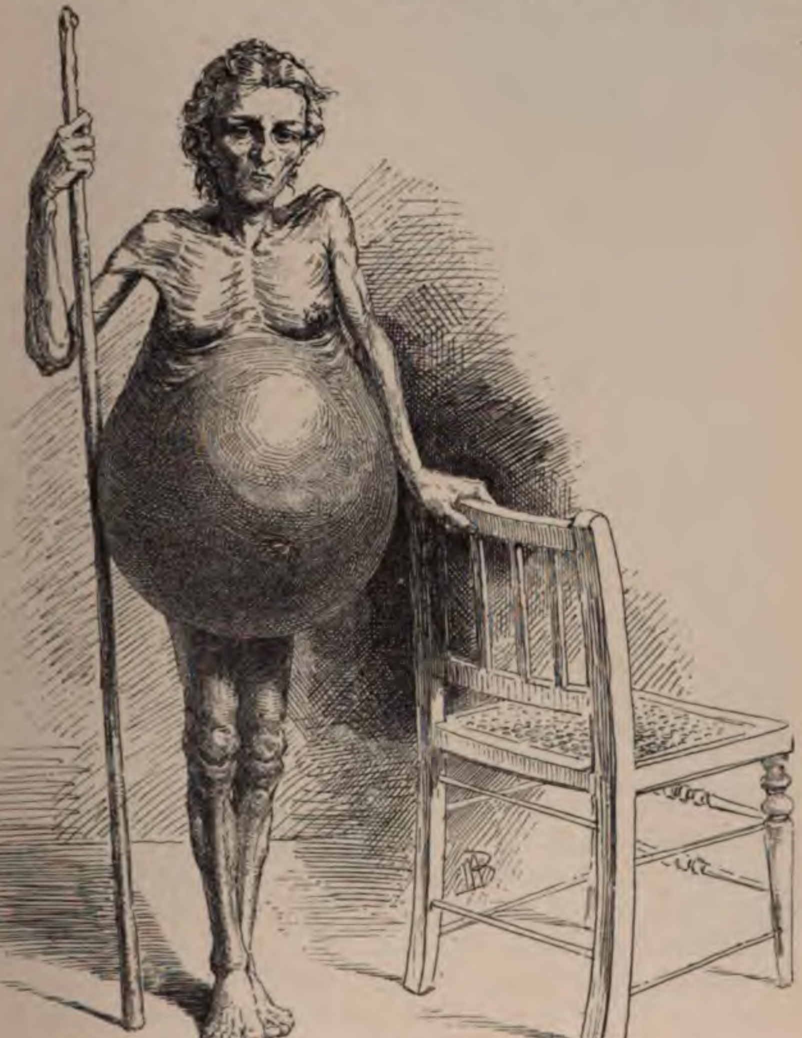


FIG. 50.—ENORMOUS OVARIAN CYSTOMA, WITH GLOBULAR PENDULOUS ABDOMEN, AND THE CHARACTERISTIC EMACIATION.

cavity, on the omentum and mesentery, the rotundity, in the nullipara, is simply increased; but in the multiparous woman the walls appear flabby and the abdomen flat and distended in the flanks. These changes occur commonly after the menopause. If an abdominal tumor is present under these circumstances, it often becomes a difficult task to make a diagnosis, and the physician may easily be misled into concluding that there is no tumor within.

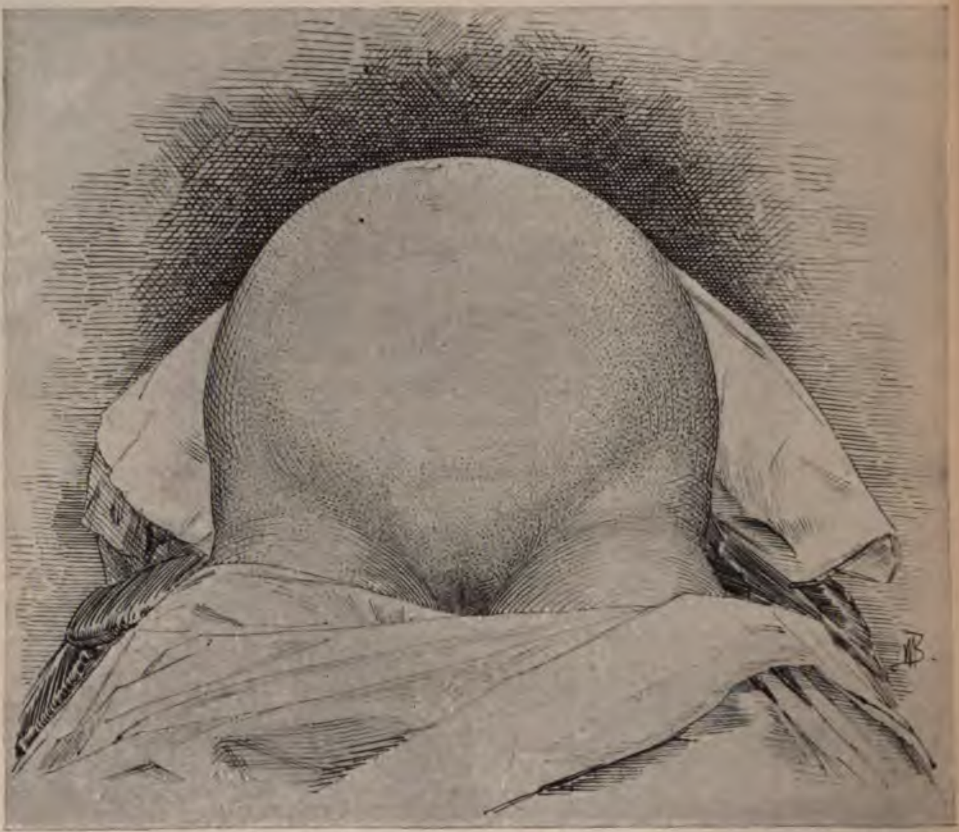


FIG. 51.—SYMMETRICAL CIRCULAR OUTLINE OF ABDOMEN CHARACTERISTIC OF A LARGE OVARIAN CYST.

The importance of knowing the normal abdomen and its variations within the limits of health becomes evident as we study the changes in form brought about by tumors in the peritoneal cavity. Such a pathological enlargement is either uniform over the whole abdomen or localized in some special area. The enlargement itself may present a uniformly convex surface, or it may be marked by bosses and grooves. A uniform increase in the size of the whole abdomen is only produced by tumors of the largest size, and by ascites. Such a case is shown in the figure of Mrs. D., who had an ovarian cyst weighing 100 pounds, which I removed in Philadelphia, in May, 1887. (Fig. 50.)

A symmetrical, convex surface over an abdominal tumor indicates a corresponding symmetry of surface of the tumor within. The contrast afforded in this way with a bossed surface serves to distinguish certain groups of tumors. In gastric, splenic, or hepatic tumors of the upper abdomen the swelling is more above, while in pelvic tumors the enlargement is mostly below.

The pregnant uterus may be taken as the type of symmetrical lower abdominal and pelvic tumors; here the chief distention is below the umbilicus, and in the first pregnancy, up to the eighth month, the prominence in the median line is like that of an ovarian cyst or a myomatous uterus of the same size.

Fig. 51. The form characteristic of large ovarian cysts is an ovoid distention of part or the whole of the abdomen, with more or less smooth outlines. Such tumors at first involve the lower or infra-umbilical part of the abdomen greatly in excess of the upper part, and if the tumor is of enormous size it may even hang below the knees. The enlargement is always uniform in parovarian cysts, Fig. 52, and in polycystic tumors with but few bosses; in the latter case the smaller nodular prominences are usually displaced into the flanks by the movements of the abdominal walls accommodating the convex smooth surface of the tumor to the concave inner surface of the anterior wall. Sometimes the surface of the abdomen appears nodular from the presence within of an ovarian tumor made up of a number of *loculi* of about the same size, or when adhesions prevent the tumor from rotating and accommodating itself.

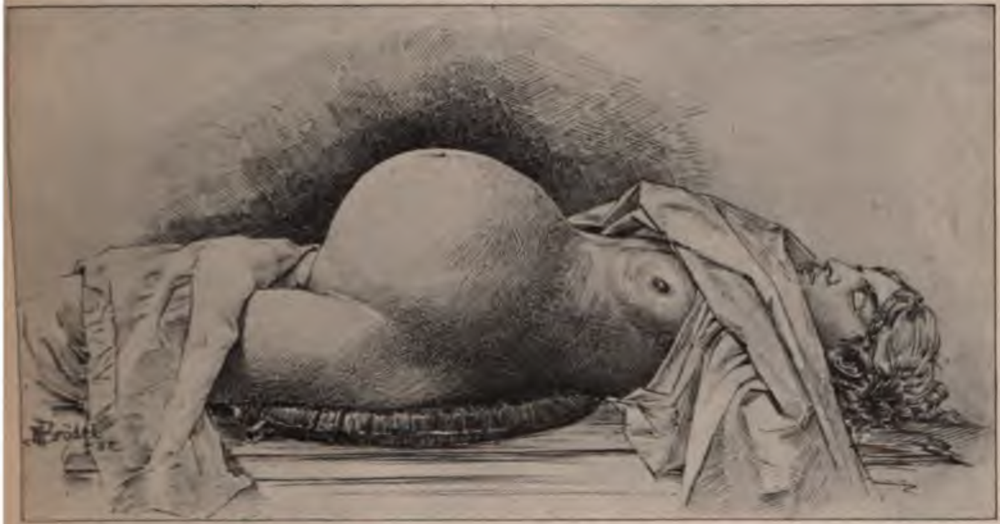


FIG. 52.—ABDOMEN DISTENDED BY A LARGE PAROVARIAN CYST.

Note particularly the more gradual line of elevation from the sternum to the umbilicus, an area rarely encroached upon by myomata.

Figs. 53 and 54. Two forms of enlarged abdomen are characteristic of fibroid tumors of the uterus: one in which the distention is spherical, looking as if the cavity contained a cannon ball, while the drop from the top of the tumor to the normal level of the abdominal wall, as the patient lies on her back, is often almost vertical. This is rarely seen in ovarian tumors. The other form has an appearance of irregular nodular masses distributed in the lower abdomen, Fig. 55.

Figs. 56, 57, and 58. Enlargement of the abdomen frequently arises from ascitic accumulations, which tend to take the form of a flattened ovoid, the regions of greatest prominence being in the flanks, whither the fluid gravitates. The flattening is a most important differential point between an ascitic accumulation and circumscribed encysted fluids, yet occasionally in a nullipara, ascites may present the domelike prominence of a cyst, and the difference can only be detected after palpation and percussion in various positions. See Figs. 57 and 58.

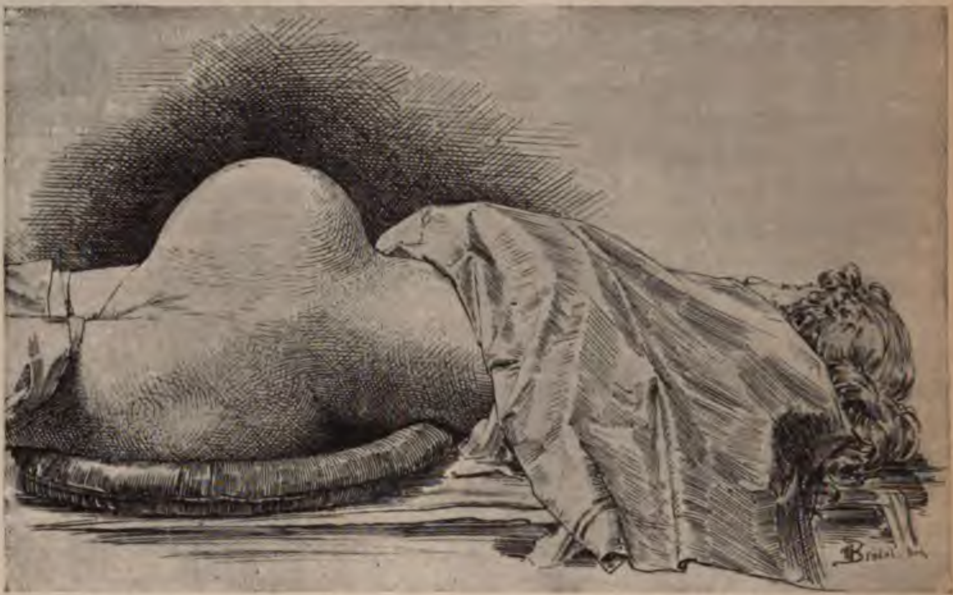


FIG. 53.—FORM OF ABDOMEN CHARACTERISTIC OF A LARGE GLOBULAR MYOMATOUS UTERUS. Note particularly the abrupt lines of elevation, especially from epigastrium to umbilicus.

Inspection is the essential factor in the diagnosis of diseases of the external genitalia, the vagina, and the vaginal cervix. The vagina and cervix can be exposed to view by the aid of instruments. Relaxed outlet, rupture of the outlet, prolapsus, and affections of Bartholin's glands, such as cysts and abscesses, etc., are diagnosed at once by simple inspection.

Inspection of the vagina and vaginal cervix is effected by means of specula. The best are Fergusson's tubular, Sims' duckbill, Goodell's bivalve, and Nelson's trivalve speculum, and Kelly's small cylindrical specula. The valvular specula are introduced to their full extent closed, and then opened, when the cervix is brought plainly into view. Upon withdrawing the speculum the vaginal walls are examined as they slowly roll over the end. Ordinary specula, however, must not be used in examining unmarried women, for they destroy the hymen and produce a dilatation of the vaginal outlet. I have often seen a distention from specular examinations great enough to admit four fingers. Small cylindrical specula, 9 cm. (3½ inches) long and 8, 10, 12, 14, and 16 mm. in diameter, must be used in examining and treating the vagina and cervix in unmarried women and girls. The patient is put in the knee-chest position, and the speculum with an obturator introduced without injuring the hymen; as soon as the obturator is withdrawn, the vagina fills with air, and every part of it, with the cervix, is plainly exposed to view by a light reflected from a head mirror.

Percussion.—Percussion is a valuable adjunct to inspection and palpation in the differential diagnosis of abdominal tumors. There are in general three kinds of percussion notes —flat, tympanitic, and dull. The flat note, drawn from the most prominent part of an ovarian or uterine tumor, is in striking contrast to the high-pitched tympany of the intestines surrounding it. The edge of the tumor is defined by an area of relative, or "tympanitic dullness."

The part of the abdomen from which an abdominal tumor has arisen may often be determined by percussion, by outlining the growth and noting on which side the resonance is wanting; in almost every case that will be the original habitat of the tumor, from which it has developed out toward the middle of the abdominal cavity, along the direction of least resistance.

The outlines of most pelvic tumors are more or less cres-

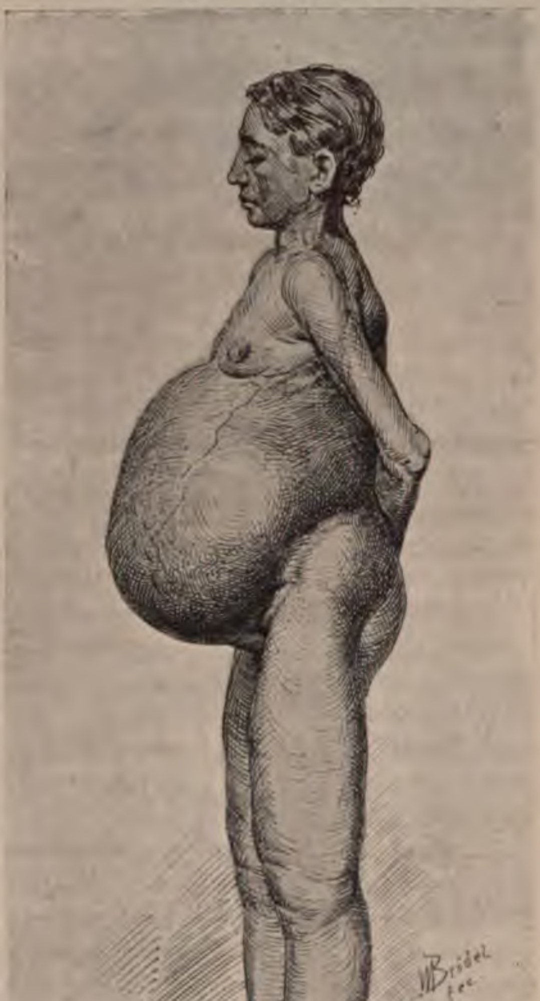


FIG. 54.—ABDOMEN DISTENDED BY A LARGE CYSTIC MYOMA, ABDOMINAL WALL SIMPLY PUSHED OUT WITHOUT SAGGING.
Note dilated superficial epigastric vein and edematous legs.

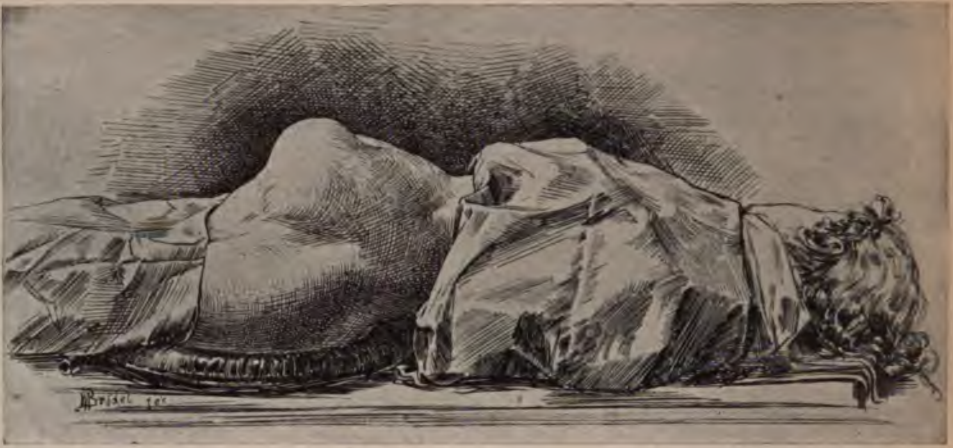


FIG. 55.—SHOWING FORM OF THE ABDOMEN CHARACTERISTIC OF A LARGE MULTINODULAR SUBPERITONEAL MYOMA WITH THIN ABDOMINAL WALLS. (See p. 90.)

centic and surrounded by an area of resonance called the corona, corona ovariana, or corona uterina.

Percussion is of the greatest service in differentiating cystic and solid tumors from tympany and ascites. The tympanitic abdomen is resonant all over; the ascitic abdomen yields a dull note in the flanks and tympany above, from the gravitation of the fluid and the floating up of the intestines. When the accumu-

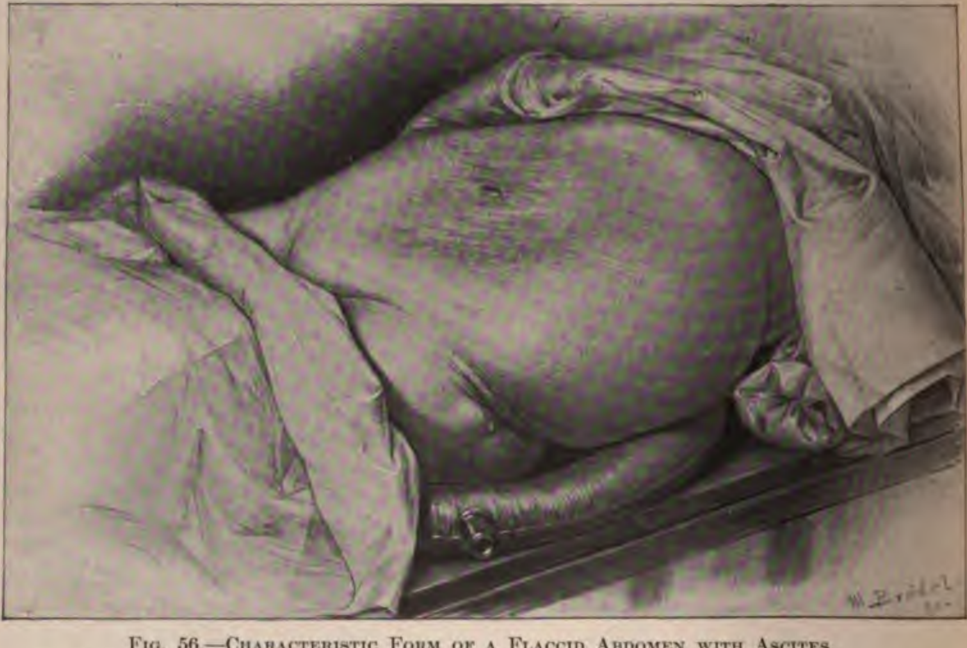


FIG. 56.—CHARACTERISTIC FORM OF A FLACCID ABDOMEN WITH ASCITES.

The fluid has gravitated down into the flanks, and the anterior abdominal wall in the median line almost rests on the vertebræ tion is extreme, however, the distention of the abdomen may be so great as to ft the walls farther from the back than the mesentery can reach; in such cases he intestines are everywhere covered with fluid, and percussion yields a flat or ull tympanitic note in all directions. Moderate accummulations may be made gravitate from one side to the other, or into the lower or upper abdomen, by hanging the position of the patient; and the dull and tympanitic areas will hange with each alteration of posture.

The most important use of percussion in diagnosis is in the recognition of n area of tympany overlying retroperitoneal tumors, usually renal, which lift e colon forward as they advance toward the anterior abdominal wall; by its eans the error of mistaking an enlarged kidney for an ovarian tumor is always be avoided.

Auscultation.—Auscultation is limited to the surface of the abdomen and is hiefly valuable in discriminating abdominal tumors from pregnancy, where the ound of the fetal heart beats is the distinctive sign. In fibroid tumors a loud ruit is often heard, caused by the free circulation of the blood in the great vas-ular channels; this must not be mistaken for the bruit of pregnancy. The only ay to make the distinction clear is by discovering other signs of pregnancy.

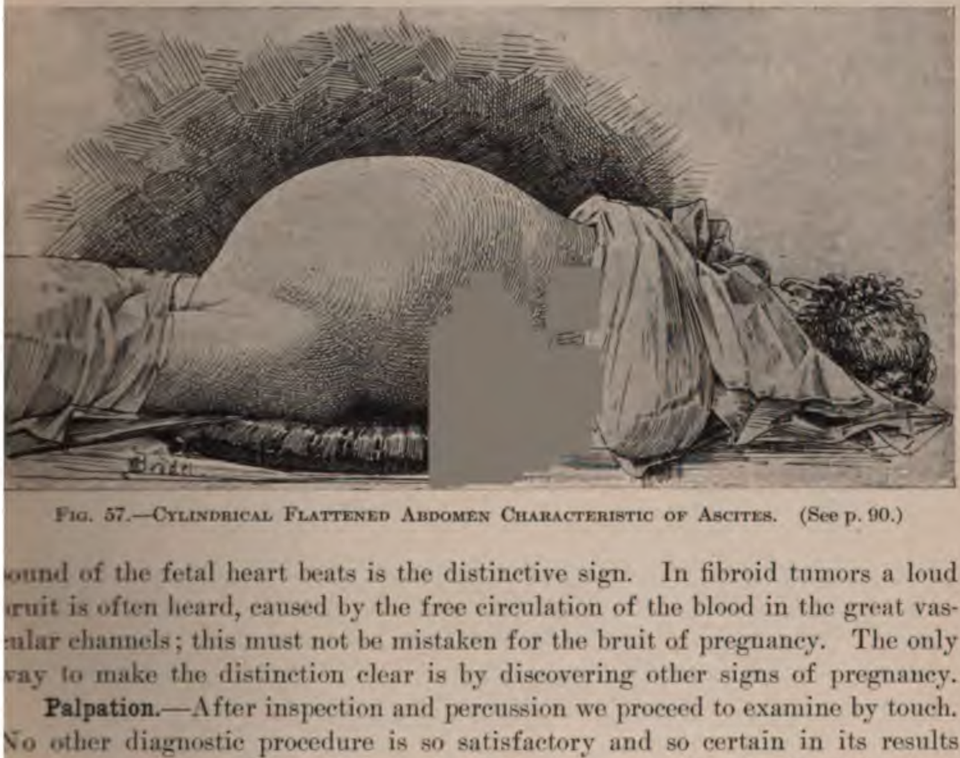


FIG. 57.—CYLINDRICAL FLATTENED ABDOMEN CHARACTERISTIC OF ASCITES. (See p. 90.)

Palpation.—After inspection and percussion we proceed to examine by touch. o other diagnostic procedure is so satisfactory and so certain in its results s the sense of touch applied to the various organs through the abdominal, aginal, or rectal walls. It is not unusual for the beginner to feel discouraged ith the results of palpation, which at first are crude and indefinite, but by ersistent practice, the tactile sense becomes acute, and the consistence as well s the minuter outlines and relations of the various organs in health and disease re easily appreciated.

By palpation we outline structures, normal and abnormal, and determine the relative position, consistence, mobility, and sensitiveness of the parts under investigation. In this way cystic tumors are at once differentiated from hard ones, and masses are easily detected in the lower abdomen, where they are hidden behind the symphysis, or in the flanks. Again, the degree of relaxation of the outlet and the condition of the vaginal walls and of the cervix are at once determined by digital palpation. Palpation is greatly facilitated by

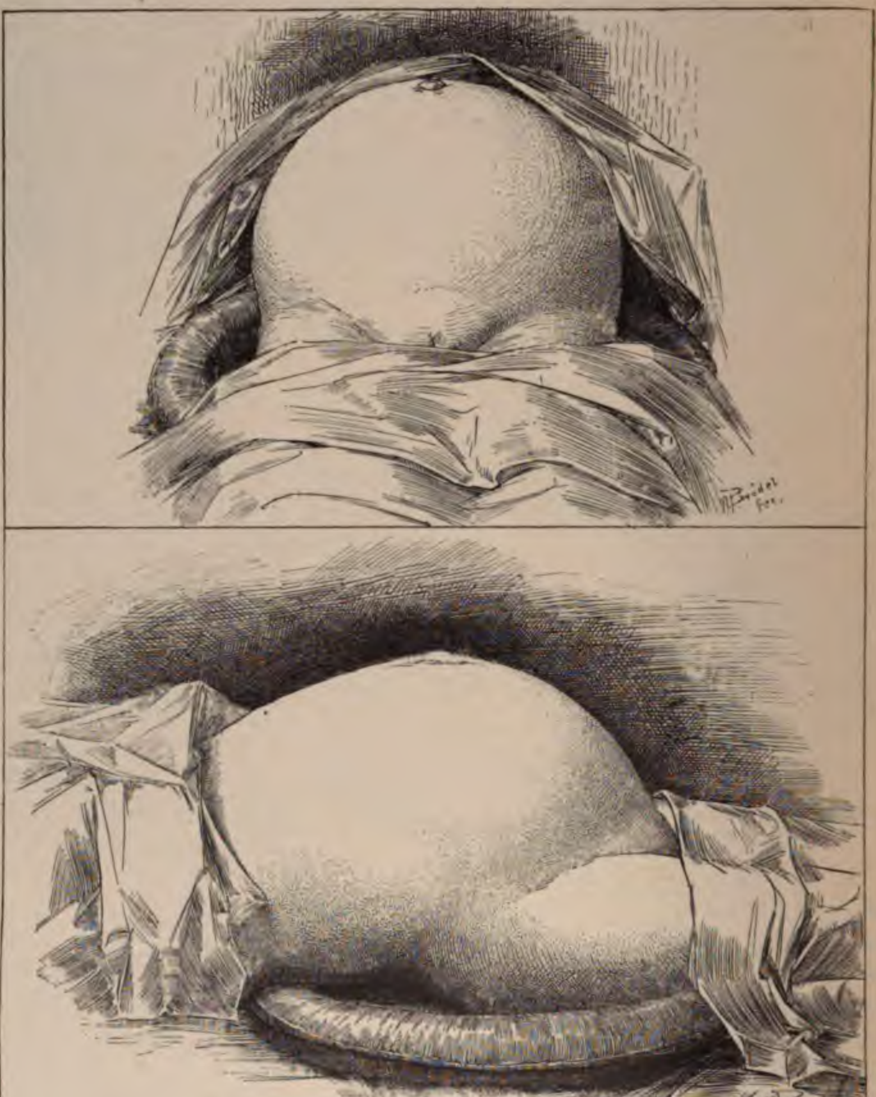


Fig. 58.—Ovarian Tumor with Ascites.

The upper picture shows the form of abdomen as seen from below; the lower picture the form seen from the side. Note protrusion at the umbilicus. M. E., op., Dec. 23, 1895. (See p. 90.)

the use of certain postures, which are so important that I shall describe them in detail.

The various useful postures are the standing, squatting, sitting and bending forward, the left lateral or Sims', the knee-chest, and the dorsal or lithotomy.

Standing Posture.—In this posture the patient stands with one foot on the floor and the other resting on a stool six or eight inches high, while the physician stoops before her and, resting the elbow of his examining hand on his knee, proceeds to make a digital examination of the vaginal outlet, the vagina, and the various pelvic organs. The hand can be placed at rest and the arm lengthened or shortened at will by supporting the leg on the ball of the foot, keeping the heel off the floor. This gives a springy support and takes away the natural tendency to stiffen the arm in pushing the hand high up into the vagina. Relaxation of the vaginal outlet and descensus uteri are most easily recognized in this way. While standing, also, if there is a movable kidney, it drops forward and is readily grasped between the hands.

Squatting or Crouching Posture.—The patient takes the same posture as in defecation, and by a slight straining effort is able to demonstrate to the examiner behind her the least tendency to prolapse and eversion of the vaginal walls. The full effect of a relaxed outlet may be brought out in this way better than by any other means.

Sitting and Bending Forward.—The patient leans forward, resting the weight of her body on the shoulder of a nurse, and so thoroughly relaxes the abdominal muscles; the examiner then sits before her or at her side, and makes counter-pressure with one hand over the back while with the other he palpates deeply through the lax abdominal walls.

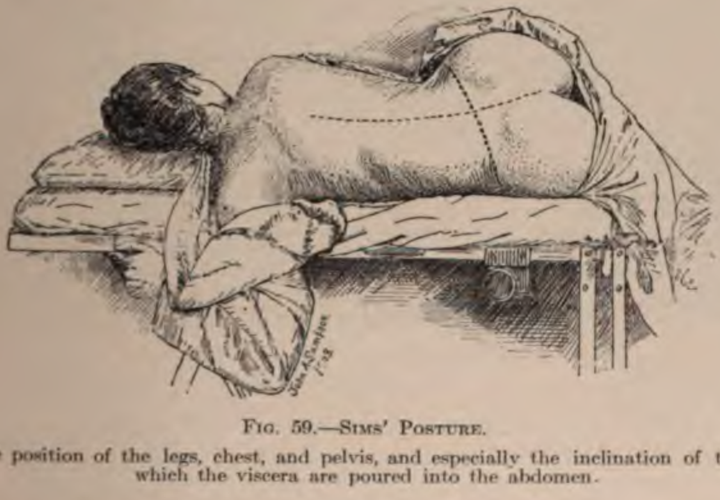


FIG. 59.—SIMS' POSTURE.

Showing the position of the legs, chest, and pelvis, and especially the inclination of the pelvis by which the viscera are poured into the abdomen.

Fig. 59. **The Left Lateral or Sims' Posture.**—In this position the patient lies on her left side with her left arm behind her back and both

legs flexed upon the abdomen, the right drawn up above the left, and the pelvis tilted decidedly over toward the table, so as to facilitate the gravitation of its contents through the superior strait in the direction of the anterior abdominal wall; this causes the vagina to balloon out with air as soon as the posterior wall is retracted. The distention will not take place, however, unless the pelvis is sufficiently tilted, so that if the patient persists in lying with her right hip vertically above the left, the difficulty must be overcome by requesting her to lie more on her stomach. This posture is useful for vaginal inspection, local treatments, and some operations. A digital examination in this position is always unsatisfactory, as the hand is impeded by the perineum.

To expose the cervix take a Sims' speculum, dip it in warm water, and anoint it with vaseline; the right buttock is then lifted up with the left hand until the vaginal outlet is seen, when the speculum is engaged in the fourchette and gently slipped back into the vagina, avoiding the urethral orifice, and following the sigmoid curve of the posterior vaginal wall, which it retracts at the same time.

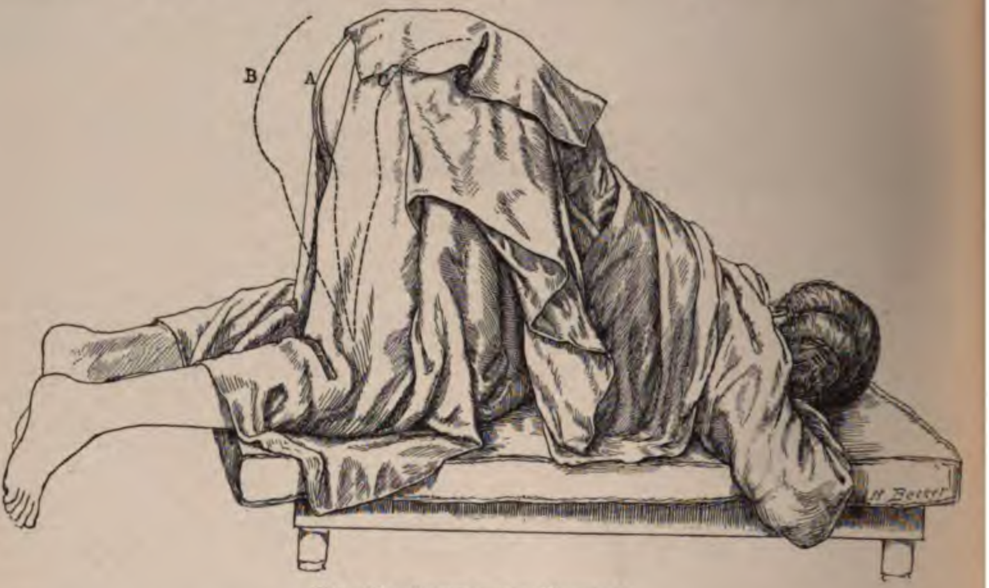


FIG. 60.—KNEE-CHEST POSTURE.

All restricting clothing is removed from chest and abdomen. The pelvis occupies one of the three positions indicated at A, B, or C, with thighs vertical or nearly so. The back is arched as much as possible and the arms spread out with the elbows commonly hanging over the edge of the table. The face is turned to one side, so as to bring the cheek as close as possible to the table. Sometimes if the expansion is not good at A, the little change noted at B and C will improve the distention, especially in the case of the bladder. This is more of a genu-facial than a genu-pectoral, or knee-chest position.

If the outlet is relaxed, the posterior wall may be retracted with the fingers alone, and the vagina and cervix exposed as well as with a speculum. In this posture, in cases of pelvic inflammatory disease, the uterus and its appendages often do not recede into the pelvis, but remain fixed by their adhesion, while the vagina does not expand.

Fig. 60. **The Knee-chest Posture.**—One of the most important methods for examination of the hollow viscera opening at the inferior pelvic strait, namely, the bladder, the vagina with its uterine cervix, and the rectum, is based on utilizing the atmospheric pressure which takes place as soon as the pelvis is elevated above the level of the remaining abdominal viscera sufficiently to create suction toward the superior pelvic strait. This distention is

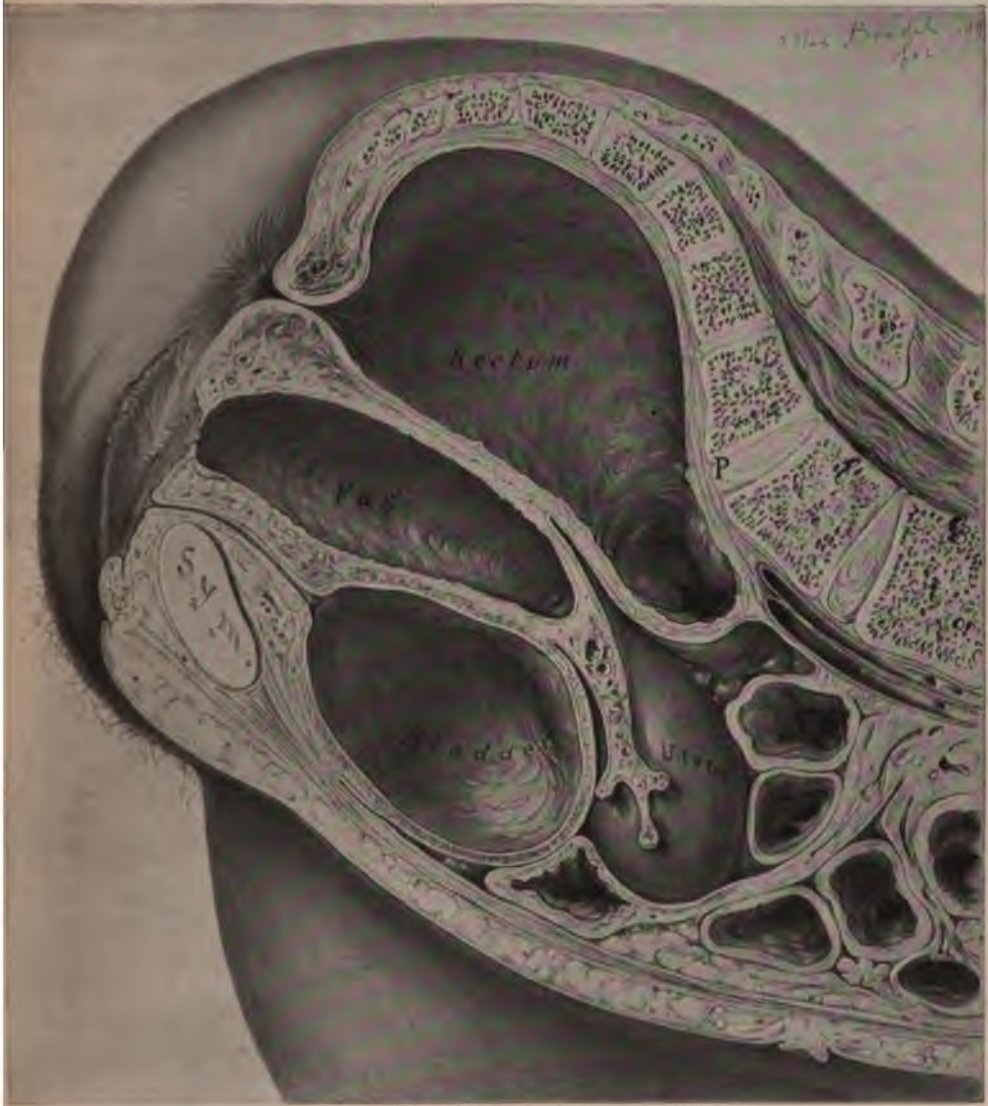


Fig. 61.—Knee-chest Posture.

The rectum, bladder, and vagina are distended by posture. The vagina as seen does not reach its maximum distention while the rectum and bladder are filled with air. It is easy to see from this figure, made from careful measurements, how readily each of the pelvic viscera can be inspected through a tubular speculum of suitable size.

seen at a maximum when the patient kneels upon the table with the thighs vertical and the chest brought as near as possible to the surface of the table. In this posture the intestines, which are hanging by their mesenteric attachment to the posterior abdominal wall, have a maximum tendency to gravitate toward the diaphragm, and thus create a species of suction, by means of which the skin surface at the pelvic outlet is visibly drawn in. If, under these circumstances, a small speculum, say 10 mm. in diameter, is inserted into the bladder, this viscus becomes filled with air as soon as the obturator is withdrawn. In like manner a larger speculum, say 2 cm. in diameter, serves for the dilatation and examination of the vagina. A speculum about 2.5 cm. in diameter, allows the rectum to fill out with air and exposes its surfaces to inspection as high as the promontory of the sacrum, or even above it (see Fig. 61).

Of the various advantages secured by this method of inspecting these hollow viscera with an elevated pelvis, one of the most important is the fact that the mucous membranes of the bladder, vagina, and rectum, which in the dorsal position lie collapsed and in numerous folds, are, in this position, expanded and spread out, until they form a smooth round surface, all parts of which can be seen within a few seconds, just as it is possible to look into a hollow ball, illumined on the inside, through a peephole. Any hidden disease lurk-

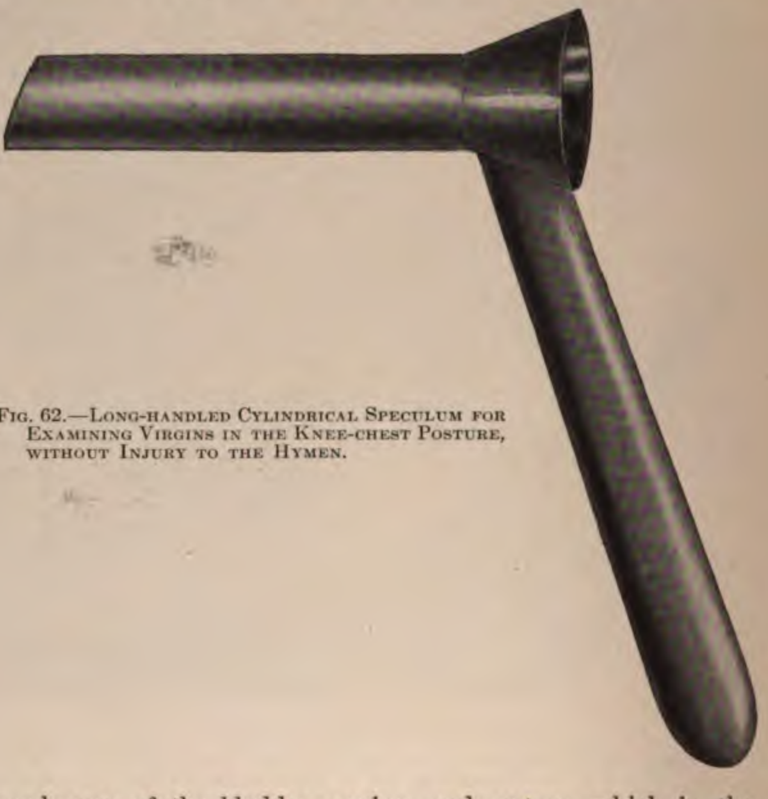


FIG. 62.—LONG-HANDLED CYLINDRICAL SPECULUM FOR EXAMINING VIRGINS IN THE KNEE-CHEST POSTURE, WITHOUT INJURY TO THE HYMEN.

ne folds of the rectum, bladder, or vagina is at once seen and often as
eated.

is the best position in examining the virgin,
whole vagina can be perfectly seen through
cylindrical speculum only 10 or 12 mm. in
, and without injuring the hymen (see
.

Dorsal Posture.—In this position the
lies relaxed on a short table, with her head
on a pillow, the legs and thighs flexed, and
with a sheet. The clothing must be drawn
e hips behind and above the knees in front,
corsets should be loosened. The effect is in-
by elevating the head and chest upon pillows
shorten the distance between the symphysis
d the sternum. By this means the recti mus-
relaxed and offer less resistance to the in-
on of the abdominal wall through the superior
a bimanual examination. The feet in the
osition should not be more than 15 to 20 cm.
rowing the knees outward, and facilitating
stigation by permitting freer access to the
If the feet are widely separated—a fault
to the arrangement of most tables and gyne-
chairs—the knees are thrown inward, and
ent's inclination becomes almost irresistible
the thighs together the moment the finger
he vulva, rendering the examination difficult,
nting it altogether.

uring Resistances.—For the purpose of meas-
sistances in the abdominal wall, so as to dif-
e between the firmer parts in relation to a
ing behind and the more yielding surround-
, I have invented an instrument which I call
meter (see Fig. 63). This consists in a
d cylinder holding a well-tempered spring;
thin the cylinder projects a long, graduated
ched to an indicator sliding up and down a
he amount of pressure made on the end of
is registered by the index from zero up to
grammes. As it is important not only to
the amount of pressure made, but the amount
pression of the abdominal wall due to a given
f pressure, I have added a fenestrated wheel which slips easily up and

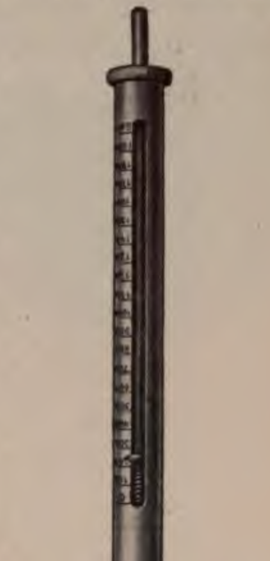


FIG. 63. — PIEZOMETER TO MEASURE PRESSURE.

The wheel slides freely upon the graduated rod below the barrel; the index in the barrel above measures the amount of pressure, while the sliding wheel registers the depth of the depression produced by pressure.

down the rod. For example, at any point over the surface of a fibroid tumor, let pressure be made on the end of the rod until the index points to 1,000; it will then be seen that the dimpling of the abdominal wall effected by this

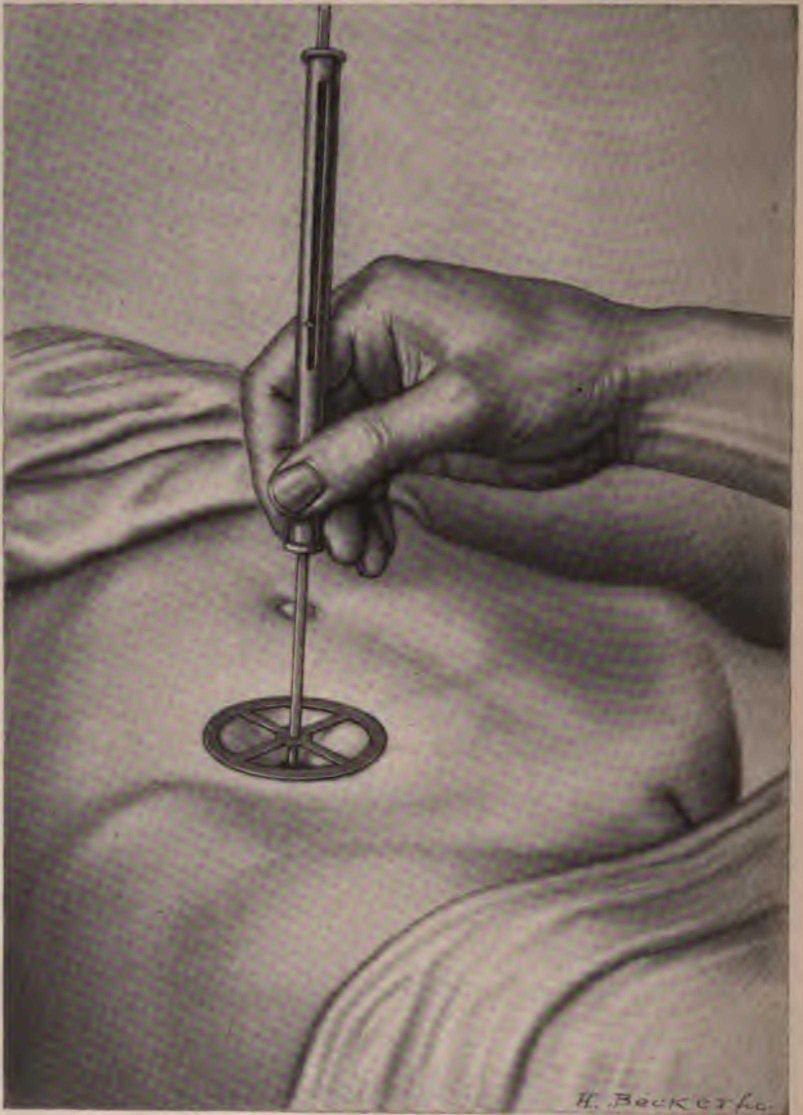


Fig. 64.—The Piezometer in Use, Measuring the Amount of Pressure necessary to Produc Pain over a Tender Appendix, as well as Registering the Tension in the Right Ilia Fossa to be Compared with the Left.

degree of pressure over the tumor is about 2 cm. The same degree of pressur made about the periphery of the tumor will cause an indentation of 4 cm., fact at once demonstrated to any number of spectators, whereas the method o palpation hitherto employed was entirely subjective and the facts it revealed were confined to the examiner alone (see Fig. 64).

The piezometer may also be used after the manner of a Boas algesimeter to register the amount of pressure necessary to produce pain. Used in this way it is especially valuable in detecting the rigidity of the rectus muscle as compared with the left, as well as the amount of pressure necessary to produce pain in the appendical region as compared with the opposite side. The piezometer thus affords an objective method of demonstrating and registering the results of palpation. Two observers may differ as to whether there is any rigidity in the right rectus muscle, but the question can be settled by the use of the piezometer without room for doubt.

EXAMINATION OF THE PELVIC ORGANS.

IN THE DORSAL POSITION.

For the sake of comparison, a knowledge of the normal pelvic organs is indispensable as a standard in judging of their condition in disease. Palpation, or examination by indirect touch, is the only accurate means of determining the condition of the uterus, tubes, and ovaries in the living subject. The normal uterus, broad ligaments, tubes, and ovaries can always be palpated by a skilled examiner. It is well to wear a thin rubber glove or a finger stall when there is any infectious discharge, or in examining by the rectum.

The methods of examination are four:

First, a simple exploration with one hand by the vagina or rectum; second, the bimanual examination through the vagina or rectum and abdominal wall, with the organs *in situ*; third, the bimanual examination through the vagina or rectum and abdominal wall, with the uterus artificially displaced backward; fourth, the examination through the vagina or rectum and abdominal wall, with the uterus drawn down to the vaginal outlet.

a. **Simple examination with one hand in the vagina or rectum:**

This is usually employed as a preliminary. Bartholin's glands are examined on both sides between the thumb and forefinger. The condition of the outlet is estimated by one or two fingers making backward pressure. The rugæ of the normal vagina are felt like rough ridges on the anterior vaginal wall, while they are smoothed out in the relaxed vagina.

The cervix is next felt as a knob-like prominence in the vault of the vagina, its axis pointing downward in a line with that of the vagina, or backward toward the sacrum, or forward toward the symphysis, according to the position of the uterus. If the os uteri points downward in the axis of the vagina, in the nulliparous woman it indicates either a marked anteflexion due to an undeveloped uterus, or a retroflexion, while in a childbearing woman it means retroflexion. A lacerated cervix, infiltrated or studded with follicles, or the indurated ulceration of carcinoma, are readily distinguished from the normal, smooth, knob-like cervix. If the uterus is slightly anteposed, its body can not be felt by one hand alone; but if it is acutely anteposed, by giving the anterior vaginal vault in front of the cervix a quick blow, the fundus will be detected as a resisting body.

In examining with one hand by the vagina, the ovary can not be felt unless it is abnormally displaced downward into the recto-uterine pouch, where it may be discovered by pressure behind the cervix uteri a little to the right or left. It feels like a rounded, somewhat elastic body, slipping up and away under the pressure. Any attempt with one hand to feel the ovary not displaced fails, or gives at the utmost but an uncertain idea of its presence; because as soon as it is touched it yields to the pressure, and is displaced upward and out of reach. An examination of the deeper pelvic structures with one hand is therefore incomplete.

b. **The bimanual method of examination as conducted either with the organs in situ or with the uterus in artificial displacement:**

The bimanual examination with the organs *in situ* depends for its success upon the invagination of the abdominal wall just above the symphysis pubis, through the superior strait, with one hand, while with the other hand the examination is made through the inferior strait. The index finger, or both index and middle fingers, if the vagina is sufficiently lax, is introduced as far as the cervix. The palmar surface of the last joint of the finger must always be used in palpating; it is a beginner's error to use the radial side of the finger. There are two ways of holding the rest of the hand which is outside during the examination, either with the fingers strongly flexed in the palm, Fig. 65, or with the thumb and fingers widely separated, the thumb resting upon the symphysis and the unemployed fingers on the perineum. The first method is best when the examination can be conducted without bending the flexed fingers beyond a right angle with the examining finger; otherwise, the second method is preferable.

Simultaneously with the introduction of the finger into the vagina slight pressure is made over the middle of the superior strait, with the tips of the fingers of the other hand resting upon the abdomen above the symphysis.

In most cases only slight pressure is required throughout to make a complete examination of the pelvic organs; in other cases it is necessary to overcome resistance by making a gradually increased pressure downward, until the structures are felt. As a rule, the outlines of the pelvic organs are not minutely examined by the abdominal hand, which serves more as a plane of resistance to prevent the upward displacement and gliding away of uterus and ovaries when touched by the finger within the vagina. When the abdominal walls are thin and lax, the outer hand may also be employed in studying the outlines of the organs.

Invagination of the Pelvic Floor.—In spite of the assistance given by the external hand, the bimanual examination would often prove unsatisfactory if the vaginal hand were limited by the length of the index and middle fingers. Invagination of the pelvic floor is therefore a necessary aid, as by this means the examining finger is practically lengthened from 4 to 6 cm. (1½ to 2½ inches). This is accomplished by pressing the perineum up into the pelvis in the axis of the inferior strait. The pubic arch and the tuberosities of the ischium are obstacles to invagination, but a skillful examiner may overcome them by cramping the fingers a little more closely together, or by making pressure farther back. Another difficulty in the way of securing the fullest advantages from this method of examining is an involuntary stiffening of the wrist and finger muscles. This may be overcome by pushing from the elbow, while the hand remains perfectly flexible, in order not to interfere with the delicacy of its tactile sense. Where the resistance is unusually great or the act proves tiresome, the examiner will help himself materially by supporting the elbow on his pelvis and pushing from his hip, relieving the arm entirely.

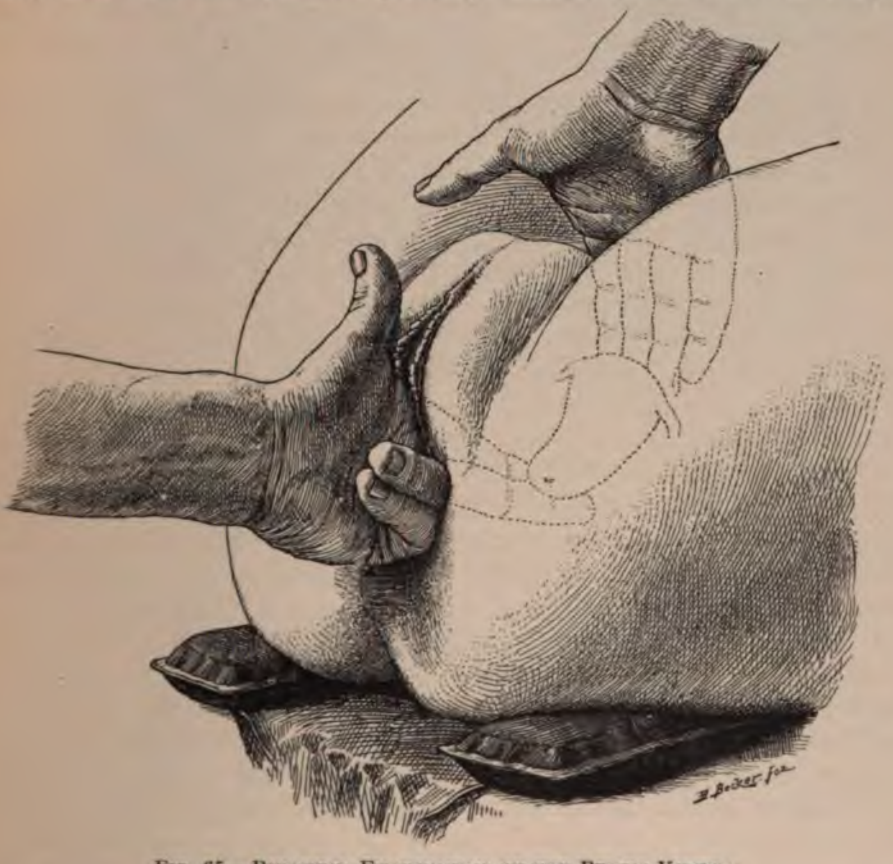


FIG. 65.—BIMANUAL EXAMINATION OF THE PELVIC VISCERA.

With the third and fourth fingers flexed upon the palm and the pelvic floor invaginated, adding an inch or more to the length of the fingers. Left view.

The examination of the uterus is begun by the vaginal hand giving the cervix a slight blow, which sends it upward at the moment the abdominal hand bears down upon the same spot. Several such movements rapidly repeated in front of and behind the cervix at once decide whether the body of the womb lies in anteposition or retroposition. When the fundus lies in advance of the cervix, by sliding the vaginal finger forward, bringing the abdominal hand a little closer to the symphysis, and pressing downward, a plane of resistance is furnished upon which the vaginal finger rolls and palpates the whole organ, while the hand above appreciates every movement given, and thus by their combined action a judgment is almost instinctively formed.

Examination of the Ovaries.—By carrying the vaginal finger far up into the lateral fornix posterior to the cervix, and then pushing out toward the lateral wall of the pelvis, while deep pressure is made with the abdominal hand in the same direction through the corresponding semilunar line, the ovary can usually be caught and palpated. It is not sufficient simply to touch the ovary; it must be caught repeatedly and allowed to slip between the fingers in various directions until it has been thoroughly examined on both surfaces and its free border. The ovary feels like a firm body about as big as the end of the thumb, with a rounded border and convex surfaces, slightly irregular. It is freely movable in all directions.

Examination of the Uterine Tubes.—These structures in their normal condition are not often easily felt with certainty through the vagina. If they are thickened by disease, the uterine end may be rolled between the fingers like a stout cord and traced outward toward the pelvic walls.

Bimanual Examination by the Rectum and Abdominal Walls.—A retroflexed fundus is felt and outlined with marvelous distinctness when held down upon the rectal finger by the abdominal hand pressing in through the superior strait. The crucial point in this examination is the recognition of the angle between the cervix and fundus, associated with the absence of the fundus in front. The ovaries are felt by making combined pressure in the same direction as in the examination through the vagina. If the ovary is not at once found, the surest guide is the utero-ovarian ligament, recognized as a prominent fold on the posterior surface of the broad ligament just below the cornu uteri; by following this out with the finger for 2 to 2½ cm. (¾ to 1 inch) the inner border of the ovary is felt. Care must be taken not to press too hard upon the coats of the bowel. I have seen several cases of rupture into the peritoneum occasioned by want of care in this respect (*Jour. Amer. Assoc.*, 1904, vol. xliv, p. 1604). Fortunately no lives were lost, as the opening was closed by either a vaginal or an abdominal section.

Bimanual Examination by the Rectum and Abdomen after Atmospheric Distention of the Rectum.—When the ordinary recto-abdominal bimanual examination is impeded by coils of small intestines filling the posterior pelvis and interfering with the fingers in their efforts to search out and palpate the ovaries and tubes, this difficulty may be removed by the following expedient: The rectum and bladder are first evacuated, the patient is put in the knee-chest posture, and a speculum introduced into the rectum.

This lets in a large amount of air, so that the bowel balloons out and applies itself broadly over the sacral hollow and the posterior surfaces of the uterus and left broad ligament, while at the same time the small intestines fall away into the upper abdomen after a minute or two. The patient must then be turned on to her back, taking care to keep the pelvis constantly higher than the rest of the abdomen, so as not to let the intestines gravitate again into the pelvic cavity (see Fig. 66).

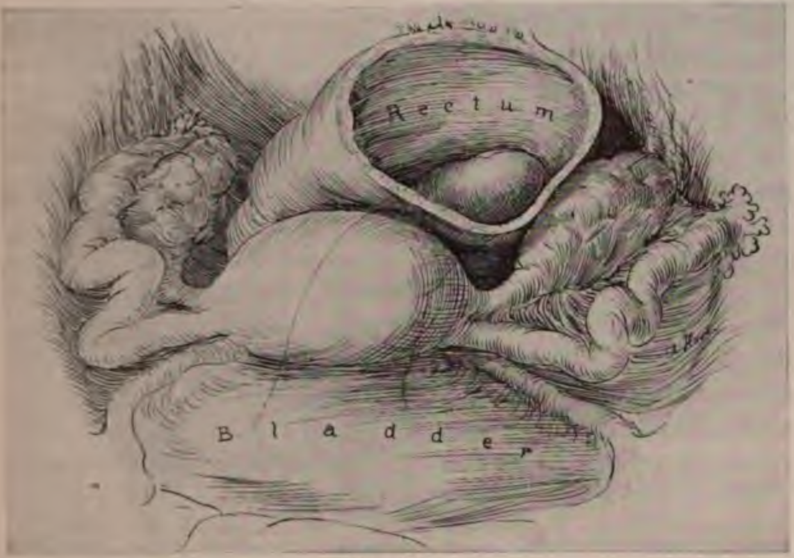


FIG. 66.

The rectum has been distended with air with the patient in the knee-chest posture; after which she is turned carefully into the dorsal posture, when the small intestines remain in the upper abdomen, leaving the rectum lying in close contact with the broad ligaments.

On making the bimanual examination the pelvic viscera are felt with startling distinctness; the rectal finger enters a large air cavity no longer impeded by the mucous folds, the opening from the ampulla into the upper bowel is readily found, and the posterior surface of the uterus with the ovaries and tubes feels as if skeletonized in the pelvis. They lie so clearly exposed to touch that their minuter surface peculiarities, fissures and elevations, and variations in consistence can be detected.

The roots of the sciatic nerve may also be palpated by the rectum, as shown in Fig. 67; such an examination will sometimes reveal the source of an obscure intra-pelvic pain which has previously been attributed to an ovarian or a uterine origin. The patient must be conscious, and as the fingers are drawn over the tender cord a cry of pain will be elicited.

When the sciatic nerve roots cannot be reached satisfactorily with the finger, I have found it a good plan, after excluding disease of the other pelvic viscera, to empty the rectum thoroughly, put the patient in the knee-chest position, and introduce a rectal speculum so as to distend the rectum with air.

The end of the speculum is then carried further and further up the bowel until the promontory of the sacrum is reached. Then, as the speculum is withdrawn, the end of it is used to make pressure on the right or on the left side of the sacrum, through the wall of the rectum, against the sciatic nerve roots.

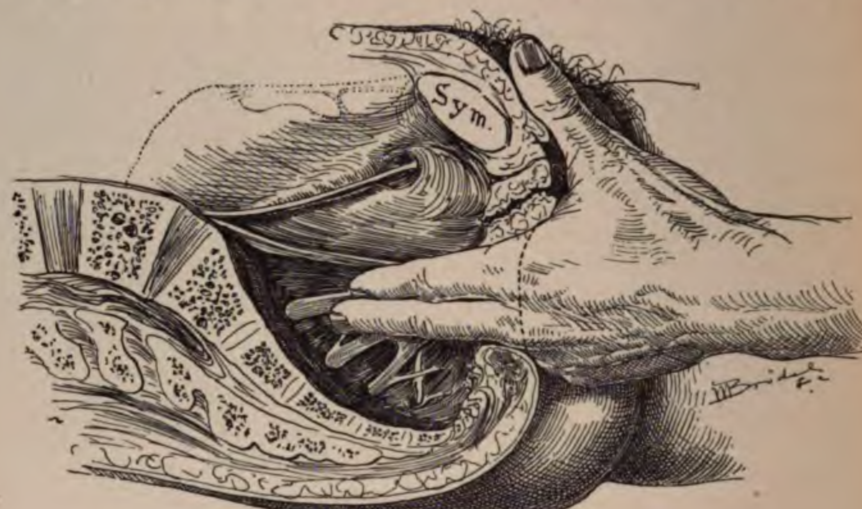


FIG. 67.—PALPATING THE ROOTS OF THE SCIATIC NERVE BY THE RECTUM.

On one occasion, when I was examining a patient who had just told me that my fingers did not quite reach the seat of the trouble, she at once emphatically declared that the exact tender spot was being touched by the speculum, and the diagnosis of an intra-pelvic affection was made.

c. **Bimanual examination in the dorsal position with elevated pelvis; the same with the uterus in artificial retroposition:**

If the pelvis of a patient in the dorsal position and with strongly flexed knees and thighs, is elevated high above the level of the body on the table, the intestines will gravitate upward and the lower abdominal walls fall in toward the pelvic viscera, which are now conveniently disposed for a searching, deep bimanual examination through the vagina or the rectum, and the abdominal walls. The examiner stands on one side of the patient and proceeds with the investigation with unusual ease, the curves of the flexed hands naturally following the hollow of the sacrum and the curved pelvic canal.

Not infrequently the posterior surfaces of the uterus, ovaries, tubes, and broad ligaments can not be distinctly palpated by any of these methods, either because the fundus lies too far forward, with the cervix too far back, or because the patient is so stout that the finger cannot reach far enough. A satisfactory examination of the surface of the uterus and its adnexa can often be made under these circumstances by forcing the organ back into retroposition and pushing it down on the floor of the pelvis, where it is easily palpated, together with its adnexa, by the vaginal or rectal finger. In order to produce this artificial retrodisplacement it is generally necessary to have the patient under the influence of an anesthetic, so that she will be completely relaxed. The examination pro- eeds as follows: The abdominal hand is first pressed down behind the symphy- is pubis to catch the fundus, while the other hand lifts it through the anterior aginal wall. The fundus brought within the grasp of the external hand by is means is caught and pushed backward in the direction of the sacral hollow. he backward displacement is finally completed by continuing the pressure on e anterior face of the uterus with the abdominal hand, while the vaginal fin- r hooked behind the cervix rotates it forward and upward. Each of these ree movements forms a step in the backward rotation of the uterus upon its ansverse axis through the junction of the cervix with the body.

While the abdominal hand keeps up the pressure, and so holds the uterus its abnormal position, the vaginal finger is withdrawn and inserted in the ectum, up beyond the ampulla, through the sphincter-like orifice between the tero-sacral ligaments, where the whole posterior surface of the uterus and the road ligaments, including ovaries and tubes, can be minutely palpated. The utero-ovarian ligaments stand out as sharply defined folds on either side of the uterus just below its cornua, and form the best guides in locating the ovaries, when they are difficult to find.

d. **The bimanual examination with the uterus drawn down to the vaginal outlet:**

The advantage of this mode of examination is that the uterus is acted upon in three different directions at once. It depends for its success upon the great atural mobility of the organ, which not only allows it to be forced back into etroposition, but tolerates a marked artificial descensus. The normal uterus ay, without injury, be displaced downward in the vagina until the cervix ppears at the hymen. In this way we secure the completest possible investi- ation of the condition of the peritoneal surfaces of the uterus and its adnexa, hort of an exploratory celiotomy, and indeed in many cases it is quite as ccurate.

Fig. 68. This method of examination is carried out as follows: First in- roduce the index finger up to the cervix, to act as a guide for the tenaculum orceps, or Kelly's corrugated tenaculum, which is firmly hooked in the anterior ip just within the canal. Then make traction, displacing the whole uterus ownward in the axis of the vagina, until the cervix is at or near the vaginal utlet. An assistant now takes the tenaculum and retains the uterus there, nd the examiner employs the abdominal hand in pushing down on the fundus o steady it, while with the index finger of the other hand he palpates, through he rectum, the whole organ and its displaced adnexa with the greatest ease. f the corrugated tenaculum is used, an assistant is not essential, for the orrugations afford a sufficient hold to be grasped between the ball of the thumb nd the middle and ring fingers, or, exceptionally, between the palmar sur- ace of the ring finger and the dorsal surface of the second joint of the little inger.

This method is of especial service in revealing small myomata on the uterus, from the size of a pea up, or cysts in either ovary, or light adhesions, or the lesser degrees of hydrosalpinx. In some pelvic inflammatory conditions such traction is dangerous; it should therefore always be preceded by a preliminary bimanual examination, without displacement, when, if doubt remains, the traction may be begun and continued only under constant observation by the rectum, and any resistance on the part of the tissues should be respected by instant cessation.

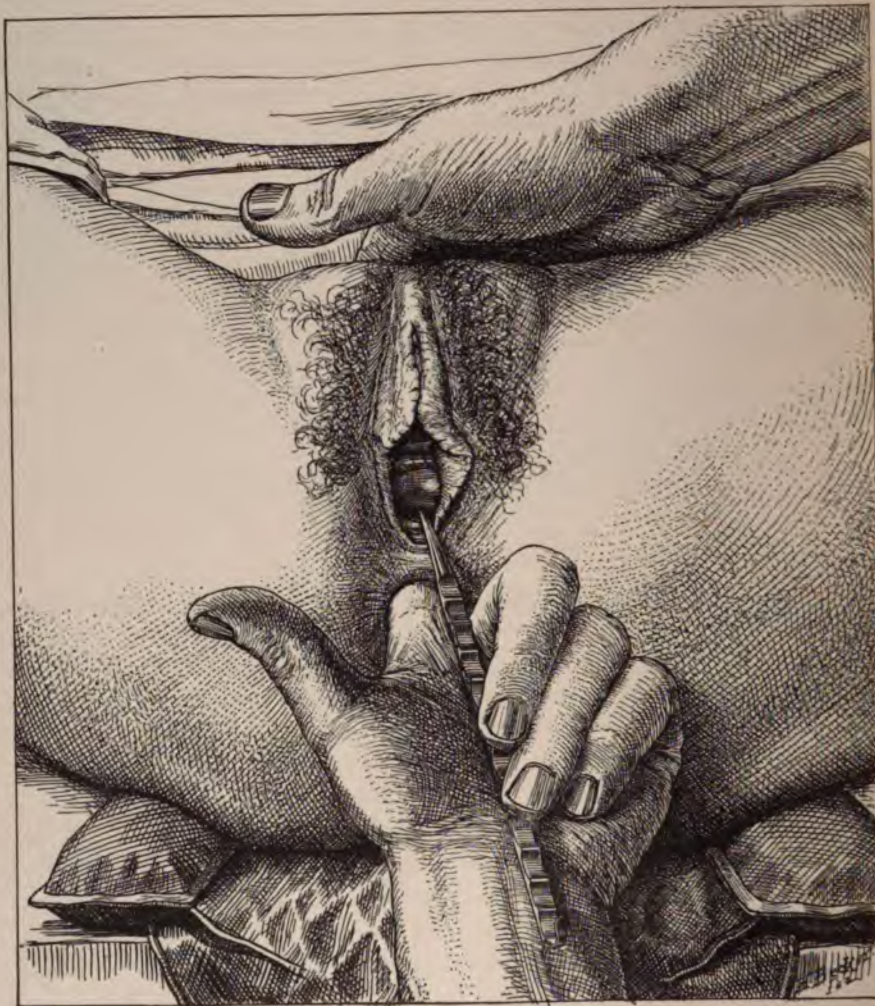


FIG. 68.—BIMANUAL EXAMINATION WITH THE UTERUS IN ARTIFICIAL DESCENSUS.

The cervix is caught with the corrugated tenaculum and drawn down to the outlet; then the tenaculum is held against the ball of the thumb, while the index finger is inserted into the rectum and used, in conjunction with the abdominal hand, to examine the pelvic organs.

One more manipulative procedure still remains for consideration:

The examination of the anterior surface of the uterus through the rectum:

This is done by displacing the uterus as just described, and adding to it a marked retroflexion, secured by hooking the index finger in the rectum over the fundus and gently pulling it down toward the anus. In this way the anterior wall can be as distinctly palpated as the posterior.

After a displacement examination of any kind, it is not sufficient to release the cervix from the tenaculum or forceps in order to restore the parts, but the uterus should be carefully put back into its original situation. To do this, the hand which has been engaged in examining through the rectum is withdrawn and washed, and then introduced into the vagina, when, by pushing on the anterior lip of the cervix, the uterus is restored to its position in the pelvis, and at the same time, if necessary, the fundus is caught by the abdominal hand and drawn into anteflexion. The patient should remain in bed from twenty-four to forty-eight hours, or longer if she continues to experience any discomfort from the examination. But the facility with which the whole manipulation is effected is usually so great that no after-effects are observed by the time the recovery from the anesthesia is complete.

EXAMINATION IN PELVIC DISEASE.

The beginner must train himself from the very outset to go through a certain routine in the examination of every case, for it is only in this way that a comprehensive view can be secured; by this routine he will also often discover important minor points which have a direct bearing on major lesions under investigation.

It is the serious fault of some examiners that as soon as they find a lesion anywhere in the genital tract which may account for some of the symptoms, they at once concentrate their entire attention and treatment upon that point, forgetting the fact that the patient may have other lesions as well. This is best illustrated by the numerous cases of lacerated cervix and " ulcers of the mouth of the womb " persistently treated where the serious disease lies in the inflamed uterine tubes.

To avoid this superficial treatment the examination begins by noting all the peculiarities of the external genitalia. The orifices of Bartholin's glands must be inspected for the *taches* significant of infection, and the glands themselves should be felt to see if they are enlarged, or if pus can be squeezed out of the duct. The state of the hymen must be noted—whether intact, dilated, or torn. The urethral orifice, by a puffy reddened condition, often gives evidence of a gonorrheal infection, and a little pus can be milked down the urethra by the finger stroking the anterior vaginal wall. By firmer pressure of the outer part of the urethra against the pubic arch, Skene's ducts are emptied of any accumulated pus. Scars at the vaginal outlet, and the relaxed condition following childbirth or the use of large instruments are also to be noted, as well as the functional activity of the anterior fibers of the levator ani muscle.

The vagina is noted as short or long, and rugose or smoothed out, especial note being taken of any cysts in it. The rectum can be palpated through the posterior vaginal wall, feeling like a stringy collapsed tube easily moved from side to side; if it contains any fecal masses this is evident to touch. Anteriorly the base of the bladder, and antero-laterally the ureters, can be felt through the vagina, and if they are inflamed, touch will always elicit complaint. The cervix is the most prominent feature in the vault of the vagina; its direction is important, whether lying in or across the vaginal axis, and its form, whether conical with a small os, or split, everted, and containing distended follicles. At the vault of the vagina, in front of, behind, or at the sides of the cervix, hard masses may be felt which will require a careful bimanual examination to determine their identity. The condition of the rectum should be carefully inquired into in every gynecological case, and any symptoms pointing in that direction should be investigated with care. The gynecologist will in this way take particular note of hemorrhoids, fissures, fistula, proctitis, and especially of strictures.

The examination of the urethra, bladder, ureters, and kidneys are described in Chapters XVII and XVIII.

The bimanual examination by one of the methods described follows next; the position of the uterus is observed, together with its size, surfaces, mobility, and sensitiveness. Finally, the tubes, ovaries, and broad ligaments are palpated.

When such a routine is regularly followed, the observer, instead of merely noting one lesion, will often find several in the same patient, either independent or in conjunction; for example, a deep laceration or a complete tear through the septum at the vaginal outlet is often found associated with extensive scar tissue in the vagina, a lacerated cervix, and a retroflexed uterus; or, on the other hand, the external tear, which is the sign of a difficult forceps labor, is associated with a pelvic tubal abscess, the sequela of a puerperal infection. One of the most striking complications I have seen was that of a patient with a gonorrheal urethritis. Pressure on Bartholin's glands squeezed out a little pus and showed she had also Bartholinitis. Pus taken from the vagina contained numerous gonococci; an endocervicitis and an endometritis were also gonorrheal. When the abdomen was opened, pus oozing from the tubes was found to contain the same organisms, and, lastly, they were found abundantly in pus taken from the peritoneal cavity.

Pelvimetry.—Pelvimetry is of the utmost service to scientific gynecology, and should be constantly practiced in all clinics, as the gynecological lesions found are often explainable by the discovery of a deformed pelvis. The various external measurements should be made as described in the obstetrical text-books —viz., the distance between the anterior-superior iliac spines, between the iliac crests, Baudelocque's diameter, and the inter-trochanteric diameter.

There are four ways of measuring the true conjugate diameter of the superior strait, which is the most important single measurement: In the first place, it may be estimated, as usual, from the diagonal conjugate through the vagina; this, however, is often impracticable in gynecology, either because the vaginal canal is too short and rigid, or because of scar tissue at the vaginal vault, or of masses in the pelvis above the vault, which prevent the necessary displacement of the vagina up to the sacral promontory. In the second place, a diagonal conjugate may sometimes be obtained under these circumstances by pressing the finger up through the rectum until it touches the promontory, and so measuring the distance to the under surface of the pubic arch. In the third place, I have found the following procedure, which I call "the external direct method of measuring the true conjugate," to be most generally useful:

The patient lies on the back, with slightly flexed thighs and knees, and the head and chest elevated, so as to relax the abdominal muscles perfectly. The examiner then stands on her right or left side, according as he intends to use his right or his left hand, with the palmar surface down. Then with gently increasing pressure he makes deep palpation above the symphysis pubis backward toward the vertebral column, feeling for the promontory of the sacrum with the tips of the fingers, sweeping from the abdominal cavity down into the pelvis, deeper and deeper each time until the characteristic median projection of the promontory is recognized. As soon as the promontory is felt he sweeps the fingers of the open, flat hand several times down over it into the pelvis, gaining a distinct impression as to its exact position; then the fingers are allowed to rest vertically above the promontory; in this way the posterior point of the conjugate diameter is fixed. The free hand now determines the anterior point, by pressing the middle finger down behind the symphysis pubis, until the most prominent point on its posterior border is distinctly felt. Directly over this an indentation is made with the finger nail on the outstretched hand. The hand is then raised from the abdomen, keeping the fingers rigidly in the same position, and the distance from the tip of the finger to the mark made on the palm will be the true conjugate diameter.

The chief sources of error arise, either from measuring directly over the summit of the symphysis, or from pressing the finger tips against the promontory instead of over it, thus interposing the thickness of the abdominal wall.

Judgment adequate to determining when the fingers are vertically above the promontory, through abdominal walls of varying thickness, is the chief factor in making the measurement. Experience will gradually eliminate grosser errors and bring a sufficient degree of certainty for practical purposes. The more contracted the pelvis the less is the liability to error.

In illustration I will cite the following case (see George W. Dobbin, *Amer. Jour. Obst.*, vol. xxxii, No. 2, 1895): Mrs. H., admitted to the Johns Hopkins Hospital, January 3, 1895; she had had two severe instrumental labors within two years, both children dying during labor. Since the second labor she had had no control of loose bowels and there was a constant dribbling of urine.

The examination revealed an extensive dermatitis with edema of the external genitals. The recto-vaginal septum was torn through and the sphincter pits separated 3 cm. (1¼ inch), although, in spite of this, the vaginal outlet was well lifted up. The vagina was smooth throughout; at the vault there was a sharp falciform scar at the junction of the right lateral and anterior vaginal walls. The cervix was stellately lacerated and divided into one posterior and two anterior portions. A sulcus of scar tissue between the two anterior portions ended at a vesico-vaginal fistula 3 mm. in diameter. The uterus lay in retroposition reclining in the sacral hollow. The tubes and ovaries were normal. On account of the dense unyielding scar tissue in the vaginal vault, it was impossible to measure the oblique conjugate either by the vagina or by the rectum. By the external direct method the true conjugate was found to be only 7 cm. The patient had a flat pelvis of high grade, the obstetrical difficulties were fully explained, and the gynecological condition etiologically accounted for.

In the fourth place, the most accurate method of all is the direct measurement of the conjugate from the sacral promontory to the posterior surface of the symphysis pubis, through the abdominal incision in the course of a celiotomy; this is easily obtained by guiding the tip of a graduated sound to the promontory by the index finger, and then feeling for the posterior surface of the symphysis with the other index finger, and estimating the corresponding point on the sound, which is now taken out and the marking read off.

This is particularly useful in pelvic inflammatory cases, where the disease has come from a difficult labor and the abdomen has to be opened to remove it.

The Seat of Pain.—A large percentage of our patients come to us because they suffer from intra-abdominal pain of some kind, and the gynecological examination should be so conducted as to determine with precision in just which organ the pain is seated. If the examiner insists upon this, there will be less likelihood of a mistake and an operation upon a wrong organ. For example, when the pain is in the left pelvis and it is possible to handle the ovary, then, if a pain similar to that complained of, is produced by pressure upon that organ, the seat of the pain will, at least, have been accurately determined. If the pain is on the right side, and pressure upon the right ovary produces similar suffering, the mistake will not be made of removing a harmless appendix. I have found so many cases of vague right-sided pain to be due to the kidney, that I have, for many years, been in the habit of passing in a renal catheter and then injecting a sufficient amount of a bland fluid to produce a mild attack of renal colic. The patient is always able, at once, to tell me whether the pain she has before experienced is located in the kidney. There is great satisfaction in bringing an intelligent patient to coincide in the diagnosis, at least as to the anatomical seat of the trouble, by thus locating the painful spot. When the patient suffers from attacks at intervals, it is often wiser to insist upon her remaining under observation until she can be followed through one or two attacks of her pain. Such a study will often clear up a diagnosis which can not always be made from the mere verbal description.

In like manner, it is always important when the patient complains of a vaginal discharge occurring at intervals, to get her to return to the office when the discharge is present, or to remain under observation until it actually occurs and can be investigated. In this way many instances of supposed intermittent pelvic abscess will be found to be nothing more than cervical catarrh, and a grave operation will be avoided.

EXAMINATION UNDER ANESTHESIA.

I feel that I can not emphasize too much the extreme importance of a routine use of ether or chloroform anesthesia to the point of complete relaxation, in investigating intra-pelvic diseases. Weeks, months, or even years of useless palliative measures will be saved in many cases if the patient is anesthetized and examined before beginning treatment. The purpose of the anesthesia is to do away with all resistance on the part of the patient, relaxing the abdominal muscles completely and preventing the possibility of unexpected resistance when tender points are touched. The examination with the anesthetic can be conducted with a thoroughness which is impossible without it, the uterus can be drawn down, adhesions pulled upon, the perineum deeply invaginated, and inflamed tubes and ovaries handled in a way which is impossible as long as the patient remains conscious.

I may add also that it is a definite advantage to the operator to be able to devote his concentrated attention to the examination, and not to be distracted by his anxiety as to how much pain he is giving his patient.

Rules for the Use of Anesthesia.—I recommend, therefore, the following rules: Use an anesthetic in all cases

(a) Where doubt exists after an ordinary bimanual examination.

(b) Where there is much tenderness.

(c) Where a patient comes to the specialist after having had treatment for a long time at other hands without improvement.

(d) In all cases of pelvic peritonitis involving one or both ovaries or tubes, without producing any gross tumor, when the use of the anesthetic is to find out the extent of the disease.

(e) Always in unmarried women.

Preparation of the Patient for Anesthesia.—The lower bowel must be emptied by taking a purgative the night before, and if this does not act freely enough, an enema in the morning. The bladder should be emptied by catheter at the last moment. It is best to examine early in the morning and about an hour after a light breakfast, such as a cup of tea and a piece of toast. The early hour has the advantage of relieving the patient from a day of anxious expectation. After completely anesthetizing her, if it is done in her room, she should be brought across the bed, with her hips projecting a little over the edge and legs and thighs held well flexed by assistants or a leg holder. It must be the aim in the examination to keep her unconscious as short a time as is consistent with a thorough investigation, in order to diminish the after-discomforts with the liability to distressing nausea. Patients who have come into the house from the outdoor department simply for the ether examination usually go home late in the afternoon of the same day, but it is better, as a rule, to keep them quietly in bed for a full day afterward.

Exposure of any part of the body during the examination must be guarded against as much as possible, no matter what the patient's station in life may be, partly on the ground of a proper respect for the sex in general, partly because of the sacred obligation to treat the patient in her helpless condition with that deference which is her due in return for her confidence in putting herself in this way into her physician's hands, and partly because of the inevitable demoralizing effect on nurses, the doctor, and assistants that comes from a careless indifference to the dictates of a proper modesty. While the patient is being examined no persons not directly interested, professionally or otherwise, should be present.

Classes of students must be admitted to the examining room in limited numbers only; in no case should more than three or four students examine the same patient, and the physician who is responsible for her must exercise a constant watchful care to keep any student from examining too long and from using unnecessary force.

The hands must be specially prepared for the examination by a thorough scrubbing with soap and warm water, and by cutting the nails short, so that they will not bruise the skin in making the bimanual examination. After each examination the hands must be washed afresh to prevent carrying contamination from one case to another. An examination should never be made with a sore hand. Vaseline is a good lubricant for the vaginal and rectal fingers. When the hymen is intact, the examination should be made, as stated in the rules, under an anesthetic; in this condition it is sometimes possible to introduce a small finger into the vagina without making any rupture, but it is better to omit the digital examination by the vagina entirely, and to conduct it wholly through the rectum and abdominal walls. If it is necessary to catch the cervix and draw the uterus down to get at the tubes and ovaries, this may be done by introducing into the vagina the bullet forceps closed, and then, guided by the rectal finger, which feels the cervix distinctly, to open the forceps and grasp the cervix.

A perfectly satisfactory inspection of the vagina, without injury to the hymen, may be made by using a small cylindrical speculum with the patient in the knee-chest position.

The Examination.—The various methods of handling the normal pelvic organs and the different avenues of access to them are also used in investigating the diseases of these organs; and the knowledge acquired in gaining a thorough familiarity with the condition and relations of the healthy organs is indispensable in estimating the presence and extent of disease, for the normal condition is the only standard of comparison. Owing to a want of familiarity with the normal structures, operators have frequently made the frightful mistake of removing sound organs.

Almost all morbid changes advanced enough to call for operative interference produce alterations of the normal structures recognizable by an investigation which considers the following points:

(a) Displacements affecting position.

(b) Fixation and adhesions affecting mobility.

(c) Inflammation and tumors affecting size and form.

(d) Any abnormal sensitiveness.

(e) Peculiarities of consistence.

(f) Information derived from curettage of the uterus.

(g) The microscopic examination of a piece of tissue excised.

(h) The microscopical and bacteriological examination of uterine, vaginal, and other discharges.

The skilled examiner never makes his diagnosis by taking these questions up and applying them one after another, *seriatim,* to a case in hand; he proceeds, on the contrary, to make the investigation with a trained touch which at once recognizes any abnormalities, and instinctively selects the essential points for more special attention. Such a plan is not without the risk of occasionally overlooking some point of importance, particularly if the examination is a hurried one.

The beginner will always find it better to take the questions up and apply them categorically, at least until the routine becomes so fixed in his mind that its application is afterward more or less instinctive. This, too, is the only satisfactory plan for a text-book.

(a) DISPLACEMENTS AFFECTING THE POSITION OF THE PELVIC ORGANS.—Descensus.—The index finger carried up the vagina notes whether the cervix is well back in the pelvis or lies low down on the pelvic floor in the axis of the vagina, indicating a descent of the uterus.

Anteflexion.—A little sudden pressure against the anterior vaginal wall with the finger will often encounter a resisting body, which at once recedes when the other hand is used to make counter-pressure through the lower abdominal wall; if the recession is prevented, and the body, palpated carefully, is found to be movable, ovoid in form, and, by carrying the bimanual palpation a little farther back, organically connected with the vaginal cervix, the uterus is in normal anteflexion. When the cervix lies in the axis of the vagina, and the body of the womb lies against the anterior vaginal wall, parallel to it, the angle between the two is very acute and a pathological anteflexion exists (see Fig. 69).

Retropositions.—The two forms of retroposition are retroversion and retroflexion, and a diagnosis is made by demonstrating bimanually (1) the absence of the fundus from its normal position in the front part of the pelvis, and (2) its presence somewhere in the back part of the pelvis, behind the cervix, by feeling it there with the vaginal finger as a round, resisting mass, and tracing its direct connection with the cervix. If the bridge of tissue joining the vaginal cervix to the body supposed to be the fundus can not be satisfactorily palpated, it will be felt more clearly if the cervix is caught with a tenaculum forceps and pulled down. The bimanual palpation sometimes shows that the fundus lies to the right or left in lateral flexion; this is due to adhesions drawing it in the direction of the flexion, or to a tumor filling the opposite side and pushing it over; or again to a large ovarian tumor of the side to which the uterus inclines, which pulls on the broad ligament as the tumor escapes into the abdomen. Figs. 70 and 71.

Ascensus Uteri.—In ascension the cervix is lifted up above its normal position in the pelvis, and in an extreme form the whole womb may be displaced out of the pelvis into the abdomen. This may happen in the case of a broad ligament tumor, or of an ovarian tumor adherent to its posterior surface and drawing it into the abdomen.

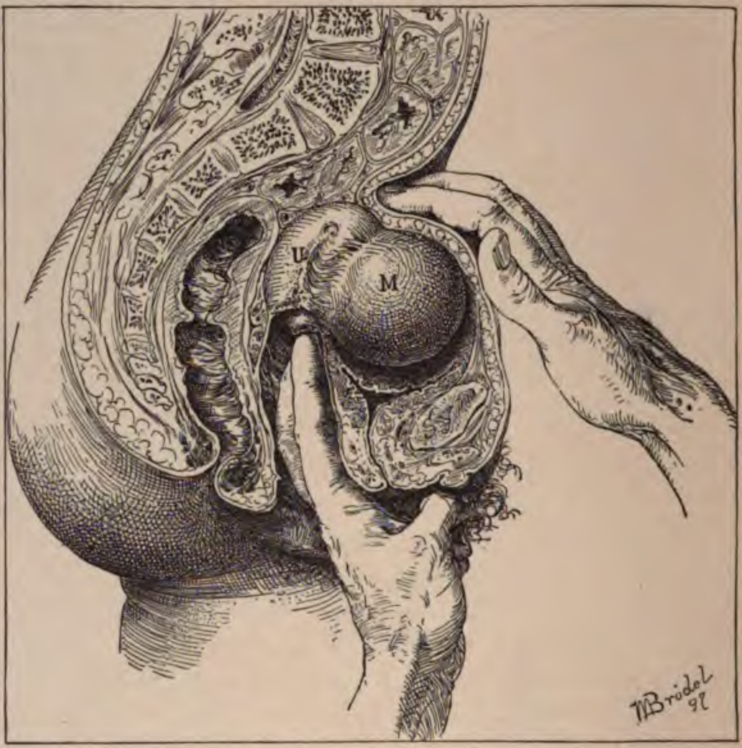
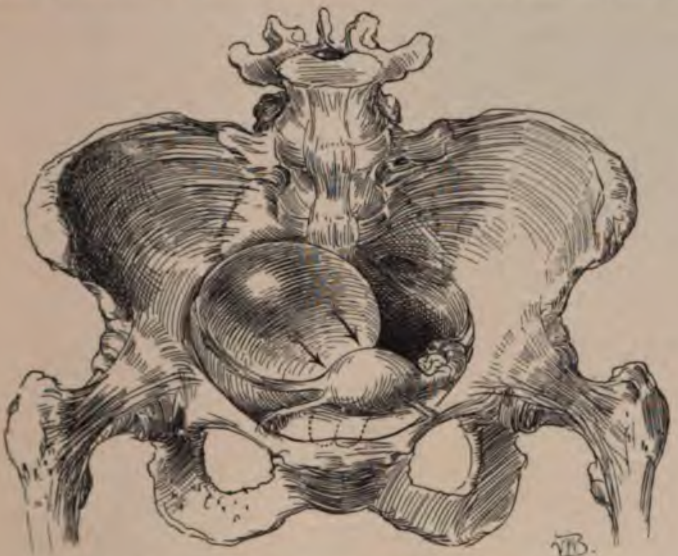


Fig. 69.—Differentiation between a Myoma in the Anterior Uterine Wall and an Enlarged Uterus in Anteflexion.

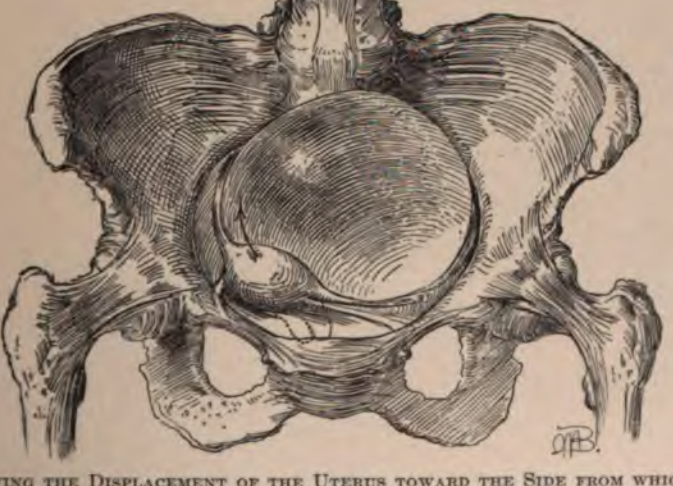
By a bimanual examination, while the vaginal fingers, resting upon the cervix, hold the mass up, the abdominal fingers are able to discover the little sulcus between the fundus and the tumor, and to appreciate the slight but distinct mobility of the myoma as separate from the fundus. H. op. Oct. 24, 1896.

(b) Fixation and Adhesions affecting Mobility.—If the uterus is found fixed in a certain position, and does not move easily upward in making slight pressure on the cervix, its condition is abnormal, and the cause must be sought for. I know of but one apparent exception to this rule, and that is where uterus responds but slightly to pressure on account of a stout tense abdomen increased intra-abdominal pressure. When the cervix is occupied by a er which has extended out into one or both broad ligaments, the whole organ



70.—Showing the Left Lateral Displacement of the Uterus, which is Pushed to the Opposite Side, in the Direction of the Arrows, by an Ovarian Cyst on the Right.

s as if held in a vise by the hard masses extending out to the pelvic walls. esions of the posterior uterine surface to the pelvic floor restrict its mobil- forming an adherent, retroflexed uterus. This is tested by pulling down the



71.—Showing the Displacement of the Uterus toward the Side from which the Tumor Grows, Due to the Enlargement of the Cyst which now Fills the Pelvis and, by Traction on its Pedicle, Draws the Uterus in the Opposite Direction.

cervix and trying to raise the fundus, when the adhesions are put on the stretch and felt. I would here caution the beginner not to conclude that a retroflexed fundus is adherent because he can not push it up through the vagina. The normal mobility is also greatly restricted in almost all cases of inflammation of the tubes and the pelvic peritoneum, which result in masses behind the broad ligaments. Ovarian and tubal adhesions are best felt bimanually with one or two fingers in the rectum. The adhesions, whether light and velamentous like a web, or short and firm, binding the ovary to the posterior surface of the broad ligament, are easily felt upon attempting to handle the ovary in order to examine both its surfaces, as described in the examination of the normal ovary. An adherent tube is almost always involved with the ovary in pelvic inflammatory disease, and is also usually enlarged.

(c) INFLAMMATION AND TUMORS AFFECTING SIZE AND FORM.—Only the trained fingers familiar with the normal organs will recognize at once all deviations in size. Both the enlarged, infiltrated, and the cancerous cervix are characteristically different from the normal; and lacerated, everted cervical lips can be recognized at once.

The trained clinician, knowing how large the normal nulliparous uterus ought to be, and what is the size of the average parous uterus, will have little difficulty in deciding whether the uterus of a young woman is undersized—that is, puerile or infantile; or, in the case of a woman of advanced years, whether it is senile. The large body of a subinvoluted uterus differs as much from the normal to the touch as a hydrocephalic head does from a sound fetal head.

The myomatous uterus, from the small nodules just projecting from the serous surface, often not as big as a pea, all the way to the vast masses filling the abdomen, presents unmistakable characteristics in the enlargements and irregular bizarre shapes assumed. Often the only suggestion of a cancer of the body of the uterus found at a first examination is the increased size and the globular form of the uterine body. In pregnancy we trace a uniform development in the size of the uterine body from the fourth week on to the end. The most sensitive touch will be the quickest to appreciate this change at its earliest stage, from the fourth to the sixth week.

The uterine tubes are changed in size and form by all inflammatory diseases, more particularly by those in which the outer extremities are occluded and the secretions retained, called sactosalpinx. With the thickening of its coats and the distention of its lumen the tube becomes harder and larger, and so is the more easily palpated. The inflamed tube assumes a sausage shape with two or three convolutions.

Alterations in the size and form of the ovary may affect a part or the whole of the organ. A little hard mass projecting from its surface is most likely a *corpus fibrosum;* a nodular swelling projecting from one part of the periphery and not more than 2 or 3 cm. (¾ to 1¼ inches) in diameter, is a cystic Graafian follicle, or the last menstrual *corpus nigrum.* A larger cystic tumor with a smooth surface, from 4 to 6 or even 10 cm. (1½ to 2½ or 5 inches) in diameter, is a Graafian cyst, or a cystic *corpus luteum*. Small dermoid cysts may also present similar characteristics. An ovarian abscess is usually distinguished by the dense surrounding adhesions, but a suppurating dermoid cyst will also present these signs. The larger ovarian tumors are usually associated with a complete disappearance of the ovary and its replacement by a smooth or irregular mass, according as there is one or a number of cysts.

(d) PECULIARITIES OF SENSITIVENESS.—Normally the pelvic organs are not at all sensitive to the ordinary bimanual manipulation. The ovaries only are painful if a decided pressure is made upon them. Frequently, however, patients come for examination in whom the only discoverable difficulty is an abdominal sensitiveness, and the most painstaking investigation fails to show any other trouble. This hyperesthesia is often confined to one ovary, generally the left, which the patient can not bear to have touched; in other cases both ovaries are sensitive, and there may be a perfectly normal uterus, so tender that not even the lightest pressure can be borne. In extreme cases the whole pelvic and even lower abdominal peritoneum shows the same sensitiveness. I know of no cause for this; it is often associated with other disturbances which are presumably circulatory. It is important that every practitioner should recognize this ailment, so as to avoid the common mistake of estimating the amount of disease present by the tenderness complained of as soon as pressure is made on the pelvic viscera. Ovaries and tubes have been removed repeatedly where the only demonstrable difficulty was a persistent sense of discomfort and sensitiveness to pressure, only to discover that the mutilation has not in the least relieved the difficulty.

Pelvic sensitiveness is also peculiarly the mark of the hysterical patient whose attention has become fixed on these organs. All inflammatory affections are characterized not only by pain during the exacerbations, but by a persistent sensitiveness of the inflamed structures, which makes it difficult to handle and outline them. Under such circumstances it is necessary to put the patient under anesthesia to make a thorough investigation.

(e) PECULIARITIES OF CONSISTENCE.—In addition to peculiarities in position, in mobility, in form, and in size, the pelvic organs in disease also exhibit marked peculiarities in consistence. Each organ has its own individual standard, differing from every other organ in this respect. For example, the consistence of the cervix is one thing, that of the uterus and ovary another. The most striking example is the change in the vaginal portion of the cervix in pregnancy from a firm, hard, resistant tissue to a soft and even flabby condition. The cheesy friability of a cancerous cervix also differs from any other state. There is a putty-like condition of the subinvoluted uterus, which indents on pressure, and which ought to be a warning against the use of the sound. I have seen the sound go through the uterine wall in these cases with as much ease as if it were a piece of blotting paper. Again, the soft semifluctuation of the pregnant uterus from the third to the fifth months is different from the hard fibroid uterus. Occasionally a vascular fibroid will simulate pregnancy.

In diseases of the tubes and ovaries there is no more important distinction to be made than the changes in consistence. In infected cases a dense hardness, which replaces the soft pliability of the pelvic floor, is characteristic, and is only imitated by adherent cancerous ovaries. The consistence of the enlarged Graafian follicle is also characteristic in the paper-like thinness of its shell, which is easily recognized by the finger. I have twice recognized a rupture in an ovarian cyst, made up of a mass of little cysts, by putting the finger through the hole which happened to be on the pelvic floor and feeling the little cysts within. The consistence of an abdominal ascites, and of a parovarian cyst or a multilocular ovarian cyst, differs in each case, and is often the most characteristic diagnostic feature.

(f) INFORMATION DERIVED FROM CURETTAGE OF THE UTERUS.—By curettage of the uterus and a microscopical examination of the scrapings we determine the difference between glandular hyperplasia, endometritis, carcinoma, sarcoma, the remains of an abortion, and tuberculosis of the endometrium (for details, see Chapter XX).

(g) THE TISSUES.—In the same way, by making a microscopic examination of a piece of tissue excised from the cervix, a differential diagnosis is established between inflammatory conditions and carcinoma (see Chapter XXXVIII, Vol. II).

(h) SECRETIONS.—The examination of the secretions, commonly called leucorrheal, from the uterus, cervix, vagina, and vulva, often gives important information, and either throws light upon the cause of an existing disease or shows the presence of elements in these secretions liable under favorable conditions to endanger health and life. The purpose of this examination is to discover the presence of one or other of the commoner pyogenic organisms —the streptococcus, the staphylococcus, the gonococcus, and perhaps the tubercle bacillus or the colon bacillus. The examination includes observations as to the presence of any secretion, its location, quantity, appearance, consistence, chemical reaction, bacteriological character, and any local reaction.

For accuracy of investigation, the following regions should be examined:

The ducts of Bartholin's glands.
The vulvar commissure.
The urethral orifice and Skene's glands.
The lower vagina.
The vaginal vault.
The cervical canal.
The uterine body.

The normal secretions, which contain numerous micro-organisms but none of the pyogenic bacteria, form the standard of comparison. No bacteria of any kind are found in the cavity of the uterus.

In young women, and in those not infected, the secretions within the vulva and at the vaginal outlet are what have escaped from the vagina above. The natural appearance of the secretion is scanty and milky-white; it consists of desquamated vaginal epithelial cells, with mucus and a few leucocytes, and its chemical reaction is acid. The normal cervical secretion is a clear, tenacious mucus. The secretion from Bartholin's glands is small in quantity, thin, and clear. There is no secretion about the urethra.

In disease there is an entire change in the character of these secretions, which become abundant, and change to a muco-purulent character. By squeezing Bartholin's ducts a drop or two of pus is made to exude at the orifice, and on separating the labia the discharge may be taken up from the commissure. To get secretion from the vaginal vault and the cervix without contamination, the patient may be put in the knee-chest position and a small cylindrical speculum inserted, which admits air and does not touch the upper part of the vagina. In the infected cases the cervix is often puffy, and its everted mucosa weeps an abundant, stringy, muco-purulent discharge from its surface. The most striking example of the utility of the examination of these secretions is that of the puerperal infections, where the exact nature of the infection may be determined. The probable nature of a pelvic abscess may be traced to a gonorrheal infection, if the gonococcus is found to be a resident in the lower genital tract. The commonest points in which a latent gonorrhea may lurk are the cervix uteri, the ducts of Bartholin's glands, and Skene's glands.

The technique of the examination for these bacteria and the methods of cultivating them are described in Chapter III.

EXAMINATION OF THE RECTUM.

The close relationship between the rectum and the other pelvic organs involves them both in many common affections, liable to affect any portion of the bowel, from the anal orifice to the brim of the pelvis. The commonest of these diseases may be arranged under three heads: (a) Fistulæ and rupture of the recto-vaginal septum; (b) extension of a malignant growth from one organ to the other; (c) compression of the bowel, either by increase in volume of uterus or ovaries, or by inflammatory products which constrict its lumen.

Examination of the rectum is also frequently called for on account of the liability of the patient to refer disorders of the bowel to the uterus and its adnexa. In this way a fissure of the rectum may be overlooked and a long and useless course of treatment undertaken to relieve a pain from a source felt higher up in the pelvis; the congestion of hemorrhoids often produces a sense of weight and bearing down in the pelvis, easily mistaken for the symptoms of prolapse of the uterus.

For all these reasons it is important to make some statement about the condition of the rectum in every gynecological record. Sometimes it is well to make the examination without special preparation for it on the part of the patient, when the physician may better judge of the habitual state of the bowel. For a thorough examination the lower bowel must be completely emptied.

Anesthesia is not necessary as a rule. There are two methods of examining—(a) by palpation, and (b) by inspection.

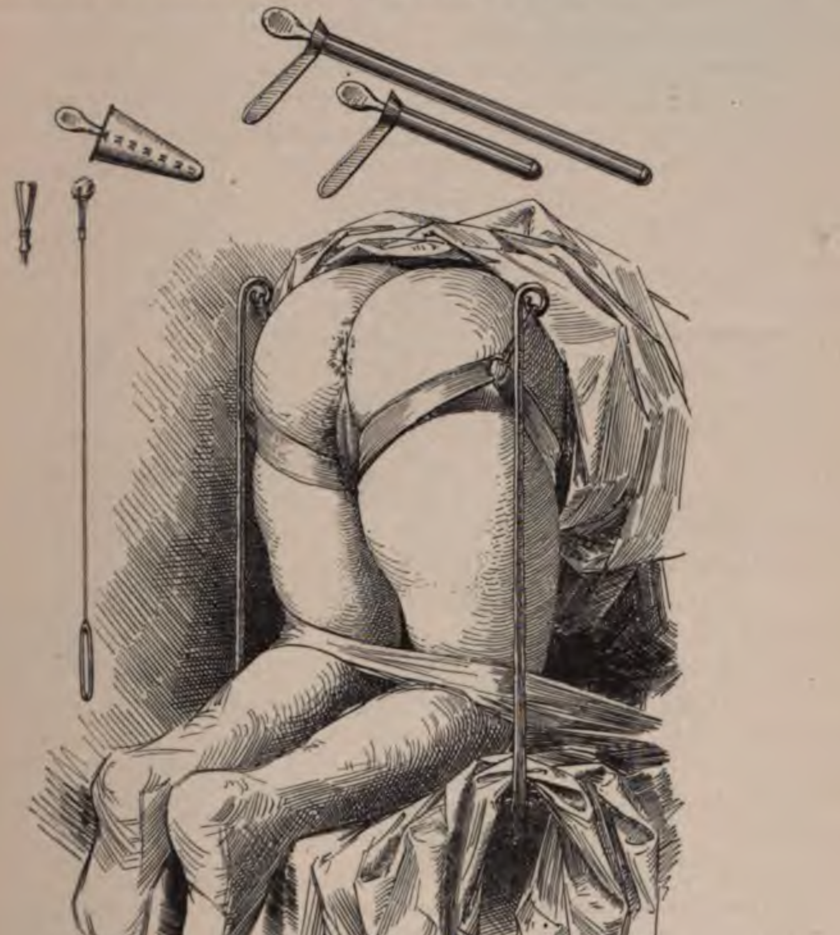
Palpation.—The finger introduced into the vagina easily feels the lower part of the rectum, from the cervix down through the posterior vaginal wall, and by pressing upon it and rolling it from side to side, its size, mobility, and sensitiveness may be estimated. The normal rectal tube feels like a flat band with longitudinal striæ, which, under pressure, slips from side to side freely and without pain. Any fecal accumulation presses forward into the vagina and gives the bowel a more cylindrical form. The presence of feces can be recognized by indenting the putty-like mass with the fingers.

The upper part of the rectum behind the cervix is often markedly sensitive, and becomes more so when it is distended. This must never be forgotten when a sensitive spot is found behind the cervix. I have seen an erroneous diagnosis made of tumor behind the uterus and " inflamed ovary " when there was really nothing the matter. A loaded upper rectum crowds out behind both broad ligaments, filling the pelvis with fecal masses, readily confused with ovarian and tubal tumors. In a more moderate distention the mass may lie on the pelvic floor behind the left broad ligament. By palpation a distended upper rectum and sigmoid flexure can be easily mapped out through the abdominal wall, if it is not too thick and rigid.

In order to make the examination, the patient lies on her back in a position of relaxation, with her shoulders slightly raised and knees drawn up. The examiner then stands on her left side, and gradually makes deeper and deeper pressure through the lower abdominal wall in the left semilunar line, until he reaches the pelvic brim, without giving any discomfort to the patient to cause her to resist. By gently drawing the fingers forward along the superior strait, the empty sigmoid is felt slipping beneath them like a large, flat cord. If it is distended it becomes still more distinct. In marked distention the bowel follows in general one of three directions: In the first, it describes a sigmoid curve behind both broad ligaments; in the second, it curves out into the anterior part of the pelvis over the bladder and then back to the sacrum; in the third the distention is upward into the abdomen and then down into the pelvis from the right side; and in the fourth, the bowel passes in front of the bladder almost to the region of the right round ligament, where it is bent on itself; when i reaches the promontory of the sacrum it makes a plunge down into the pelvis.

These fecal tumors are diagnosed bimanually by being continuous with a fecal mass behind the vagina or behind the uterus low down, about the nature of which there is no doubt. They occupy peculiar positions in the upper pelvis, are elongate, and markedly movable on account of a long meso-sigmoid; they are often made up of a number of scybalous nodules. The customary sensitiveness must not mislead. Any doubt remaining after such an examination can be cleared up by a purgative or enema, and by an inspection with a sigmoidoscope.

A digital examination of the anus shows the existence of abnormalities, and the finger is carried up into the ampulla and the rectum immediately , it demonstrates the presence of any marked changes, more especially con- ion by inflammatory masses; when the finger passes between the utero- l ligaments it seems to be entering a long, rigid tube with smooth walls. l the redundant folds of the ampulla it is sometimes hard to find the en- e into the bowel above. The proper point is best located by taking the x as a guide and seeking the opening directly behind it.



72.—Patient Supported by Uprights and Straps in Position for a Rectal Examination.

instruments—conical sphincter dilator, proctoscope, sigmoidoscope, applicator with cotton —are reduced in proportion to the size of the patient. (See p. 124.)

spection.—Under inspection the whole mucous surface of the lower bowel osed to view, from its external orifice up to the sigmoid flexure and colon, ny alterations in color, or unevenness of surface and deposits, together with changes in caliber and points of fixation, are at once evident. To make the best possible examination in this way, the bowel must be emptied of feces and the patient placed in the knee-chest posture; the thighs should be vertical, the back well curved in, and the chest as close as possible to the table; the patient should wear no corsets or any constricting garments on the upper abdomen (Fig. 72). A cylindrical speculum of suitable length and caliber is now introduced and the bowel examined by a light reflected from a head-mirror.

The following specula are useful: A short and a long proctoscope, a sigmoidoscope, and a sphincteroscope.

The cylinder of the short proctoscope is 14 cm. (5½ inches) long and 22 mm. in diameter; the long proctoscope is 20 cm. (8 inches) long and 22 mm. in diameter; and the sigmoidoscope is 35 cm. (14 inches) long and 22 mm. in diameter. At the outer end of the cylindrical tube is a funnel-shaped rim to which the stout handle, big enough to be grasped in the whole fist, is attached. Each speculum has an obturator, blunt at the end and provided with a strong stem and handle.

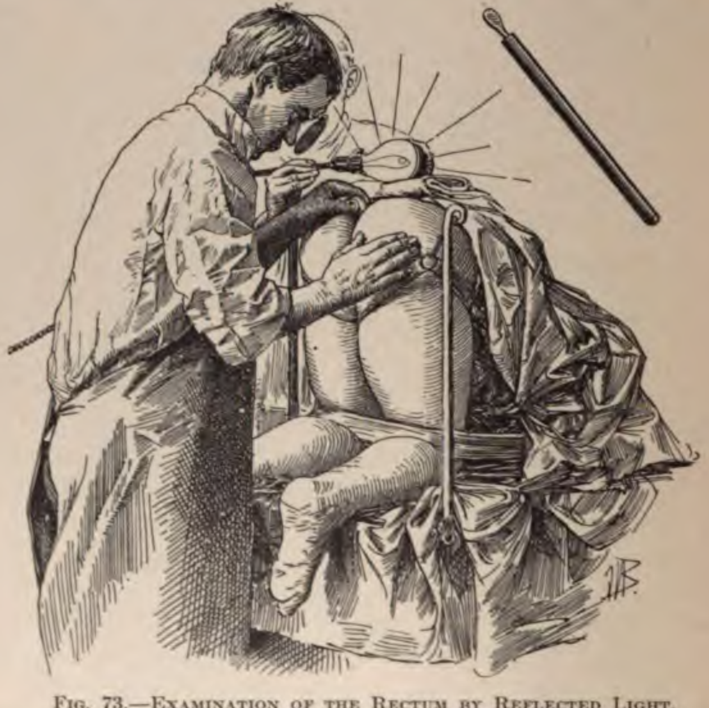


FIG. 73.—EXAMINATION OF THE RECTUM BY REFLECTED LIGHT.

The instrument seen above to the right, drawn on the same scale of reduction as the body, is introduced to its full length. The electric light, held by an assistant close to the sacrum, is reflected down the tube by a head-mirror. This picture is drawn from a photograph.

The sphincteroscope is short and slightly conical, the diameter at the lower end of the tube being 2.5 cm. (1 inch) and at the upper 3 cm. (1⅕ inch), while the outer rim of the funnel-shaped flange is 5 cm. (2 inches) in diameter.

The strong handle is set on this. The obturator is like that in the other specula.

To make the examination, the speculum is coated with vaseline and the buttocks are drawn apart, exposing the anus. The round end of the obturator is laid upon the orifice, and, grasping the speculum in the fist so that the palm keeps pushing the obturator in, it is carried into the bowel in a direction at first downward and forward, and then upward toward the sacral hollow. Sometimes the end catches in the groove between external and internal sphincters; if this happens, it must be withdrawn and pushed in again in a slightly different direction. As soon as it has fairly entered, the obturator is pulled out, and the air rushes audibly in, widely distending the bowel. The examination is now made by reflecting the rays of light from an electric droplight, or a lamp, or good daylight, by a head-mirror, down the tube into the bowel, which is so well illuminated that the smallest points on its surface become visible (Fig. 73). It is possible to detect differences not larger than the pores on the palm of the hand. It will often be found that the speculum is turned too much downward, and that it is necessary to drop the handle to bring an extensive area of bowel into view. By turning the tube a little from side to side the whole dilated ampulla is inspected in a few moments. The ground color of this and other parts of the bowel is a pale red, with large vessels like veins dividing up the surface at wide intervals. The normal bowel is never intensely red and injected in this posture, neither does it have a hazy appearance.

After studying the ampulla, upon looking up the lumen of the bowel a series of half valves are seen cutting into its lumen on the right and on the left. The tube passes easily through each of these, displacing first one and then another, without perceptible resistance, exposing to view successive lengths of the bowel hugging the sacral hollow. The promontory often appears characteristically projecting as a rounded, smooth eminence on the upper surface; its bony nature is evident on touching it with the end of the speculum.

The bowel distends so widely in this position that any fecal masses lie loose in the lumen, and the speculum may often be carried beyond without removing them, and without their choking its lumen. Sometimes, on introducing the speculum, the bowel will be found in the act of gradually opening up, expanding fold by fold. The dilatation ceases in some part of the sigmoid flexure, where the mucous surfaces suddenly come together, but by slightly pushing with the end of the speculum, or by observing the mucous folds as they part in the escape of flatus, the lumen is found, and the speculum can be pushed still farther up, although the view is no longer so perfect as in the lower atmospherically distended bowel.

To continue the inspection beyond the rectum on up into the sigmoid flexure, the longer reach of the sigmoidoscope is necessary. The direction of the instrument is no longer confined to the median line, but by degrees turns more and more to the patient's left. I have introduced this speculum as far as 30 cm. (12 inches) beyond the anus.

The purpose of the inspection is to note all alterations from the normal appearance of the bowel, such as patches of congestion, mucus lying on the surface, ulceration, and polyps. Strictures, most commonly, are found in connection with pelvic tumors, when there is a sudden narrowing of the lumen, beyond which the speculum can not pass, and the bowel seems rigidly fixed.

Pelvic peritonitis, especially that form due to abscesses in the ovaries and tubes, is particularly liable to produce stricture of the rectum at any point from the brim of the pelvis down to the ampulla. In one of my cases the rectum was choked by a large tubal abscess on the right side; above the constriction, which extended from the ampulla to the upper part of the pelvis, the bowel was greatly distended, and there was an opening between the sac and the rectum. In another case, in which dense inflammatory masses with abscesses on both sides were taken out, together with the uterus, a tight stricture of the bowel was found just below the promontory of the sacrum. This was about 4 cm. long, and not more than 1½ cm. in diameter, measured on the outside.

A fistulous orifice seen foreshortened in the side of the bowel is easily passed over, and must be carefully sought for by pressure so made as to flatten the mucosa out on the end of the speculum.

The sphincteroscope is used by pushing it into the ampulla, withdrawing the obturator, and then drawing the speculum out a little until the inner sphincter circle begins to close over it, after which it is pushed in again. In doing this it does not re-enter the portion of the bowel just left, but simply spreads the area within view over the end, giving a flat field for inspection. In this way, step by step, the whole sphincter area is exposed, and any abnormalities easily detected. For children and nervous patients who are difficult to examine, a speculum 12 cm. long and only 18 to 20 mm. in diameter is most useful.

EXAMINATION OF THE VERMIFORM APPENDIX.

The gynecologist must be familiar with the position of and the methods of palpating the normal and diseased vermiform appendix, in order not to confuse its affections with those of the right tube and ovary, which are near by. We owe the discovery of this valuable means of diagnosis to Dr. George M. Edebohls, of New York (see *New York Jour. of Gyn. and Obst.*, Feb., 1894, and *Am. Jour. of Med. Sci.*, May, 1894).

Under ordinary circumstances the normal vermiform appendix can be felt through the abdominal wall, against its underlying iliac muscle, as a short distinct cord, moderately, or not at all sensitive, extending from its base at a point in a line between the umbilicus and the right anterior-superior iliac spine, downward and inward to the pelvic brim. To find it the patient lies on the back with the abdomen bare and thighs flexed without effort, while the examiner, standing at the patient's right side, makes pressure inward in the right semilunar line just below McBurney's point. He increases the pressure gradually until the posterior abdominal wall is reached; it is against this as a background that the appendix is to be felt.

The fingers, keeping up the pressure, then glide in a direction downward and outward toward Poupart's ligament, until a delicate, cord-like structure is felt to slip beneath them. The maneuver is then repeated a little higher up, and then a little lower down, changing the position until the length and direction of the appendix are ascertained. The upper end disappears at McBurney's point, and the lower end at the brim of the pelvis, as a rule. A loop of intestine or of muscular fibers in the abdominal wall may be mistaken for the appendix, but any overlying small intestine may be disposed of by placing the patient for a few minutes in the knee-chest posture, when by careful attention the more superficial position of the muscular strands will be recognized. A diseased appendix is often still more easily recognized from its extreme sensitiveness and its increase in size, making it feel like a big, hard cord, more or less fixed.

If there is an inflammatory exudate about the appendix, the organ can not, as a rule, be felt, but the position and distribution of the mass are both characteristic of appendical, as contrasted with tubal and ovarian inflammatory disease.

An exception to the general principles here laid down are those cases in which the inflamed end of the appendix lies in the pelvis, involved with the right tube and ovary.

INVESTIGATION OF THE GENERAL CONDITION OF THE PATIENT.

Upon completing the gynecological examination, the specialist must turn his attention to the condition of all the other vital organs in the body, associating the results with the facts elicited by the examination of the pelvic organs; he is then in a position to estimate the relative importance of any gynecological ailment.

This examination is valuable in several ways: It often happens that the pelvic disease is but a part of a general morbid condition, or is dependent upon disease elsewhere for its continuance; this is the case when pulmonary phthisis is associated with tubercular tubes and ovaries and tubercular peritonitis, or when a disposition to uterine hemorrhage is but one of the manifestations of a crippled heart or a cirrhotic liver. On the other hand, a pyonephrosis may be due primarily to a pelvic abscess blocking the ureter and furnishing the source of infection.

It often happens, too, that there may be some grave organic disease of one of the other organs which is simply an accidental complication, but nevertheless forbids the performance of any serious gynecological operation.

The inquiry will be commenced by asking about any strong family tendency to hereditary disease which may bear an etiological relation to any local affection, or so complicate the local conditions that they must be taken into consideration in the prognosis and treatment. The risks attending a plastic operation upon the cervix or vagina, for example, are of no moment in properly selected cases, but they may be followed by disastrous results if certain constitutional diseases, such as advanced nephritis, tuberculosis of the lungs, diabetes, etc., are overlooked.

The main points of the general gynecological examination, are age, heredity, temperament, habit, color, and the following diseases: tuberculosis, pneumonia, pleurisy, hydrothorax, heart disease, affections of the alimentary tract, diseases of the liver, spleen, and kidneys.

Age.—Other conditions being equal, women between the ages of twenty and forty withstand the effects of operation best. But, with Dr. Mary Sherwood, I have carefully collected statistics in 100 cases which show that ovariotomy in women between the ages of seventy and eighty-two is attended with a mortality only slightly greater than in women of younger years (*Johns Hopkins Hospital Reports*, 1893, Vol. III, p. 509); in 115 cases in the hands of 66 operators, only 12 per cent died. (See Chapter XXXV, Vol. II.)

Between twenty and forty, women are in the prime of life and resist the effects of shock, hemorrhage, and infection better than those whose vital forces are impaired by advancing years. In the aged the minor gynecological ailments, such as retroflexion, lacerated cervix, relaxed outlet, and often even the marked forms of prolapse of the uterus, should not be treated by operation unless the patient experiences serious discomfort. The old are much more easily depressed by the loss of blood, and recover more slowly from shock. Convalescence is longer with the aged, because the recuperative powers are feebler. Carcinoma of the uterus in its early stage and diseases of the appendages, which, if not interfered with, will destroy health or terminate life, should be submitted to operation regardless of age, if this is the only contra-indication.

Heredity.—The hereditary predisposition to certain diseases must be carefully inquired into, because any marked family tendency may have an important bearing on the etiology. When there is an hereditary tendency to insanity, especially in patients inclined to be morbid or melancholy, any operation is attended with risk of precipitating an attack of insanity, as a post-operative complication. In neurotic families the results of surgical work are always less satisfactory. A family tendency to excessive menstrual flow may account for what would in other cases be significant of disease. A strong tendency to cancer in the family will arouse suspicion as to cervical erosions or persisting uterine hemorrhages.

A family tendency to tuberculosis of the lungs in a patient who has the general appearance of being tubercular, without signs of the disease, must put the operator on his guard, as the convalescence is apt to be slow, and the patient is often a long time in acquiring any vigorous health.

Temperament.—The temperament of the patient exercises more or less influence on the results of operation, and it is a good thing for the surgeon to study the character and disposition of his patient beforehand. Bright, cheerful women approach an operation with more composure and recover from its effects more rapidly than the despondent. A buoyant disposition is especially helpful in shortening the convalescence.

Hysteria and various neurotic ailments often accompany pelvic diseases in women, and the effects of their presence must be noted and weighed well before operation. On the other hand, certain classes of nervous patients need a strong mental impression made upon them, and are greatly benefited by even trivial operations. In hysterical women the convalescence is often marked by nerve storms which are difficult to control.

I have seen patients so discouraged by the naturally depressing effects of the disease, superadded to a despondent temperament, that they refused to acknowledge they were any better after complete relief of their ailment.

Bodily Habit.—The better the general health of the patient, the better able is she to withstand the effects of operation. It is, however, a constant matter of surprise to note the rapid recovery of comparatively feeble and delicate women from the effects of a severe operation. A robust appearance is not always the best indication that the convalescence will be short. The imponderable factor of vitality has everything to do with it.

Color.—Contrary to the common dictum, I find the negress less demonstrative after operation than white women. She frequently approaches the operation with greater fear, but her naturally buoyant, forgetful nature gains the ascendency soon afterward, and she makes a rapid recovery. The mulatto, on account of her mixed strain, may show the same characteristics as the negress, or she may partake of the higher nervous development of the white race.

In making an examination it is helpful to know of any especial racial tendencies. I find that out of 91 operations for pelvic diseases in colored women, 32 per cent were for myomata; 50 cases were of pelvic inflammatory disease; there were 3 cases of extra-uterine pregnancy, and 1 ovarian cystoma; there were also 3 dermoid cysts, 1 papilloma, and 1 sarcoma. The marked preponderance of the fibroid tumors and inflammatory diseases, and the conspicuous absence of the glandular ovarian cystomata, are striking features in the *résumé* of cases.

After such a general consideration of the status of the patient following the pelvic examination, all the important organs of the body should be examined *seriatim.* It is often most convenient to proceed directly from the pelvic examination to that of the abdominal viscera. When the history points to some chest complications, the heart and lungs will naturally be examined first.

Lung Diseases.—Tuberculosis of the lungs must be sought for and its extent carefully noted. Even a pneumonia might be overlooked in the absence of making a routine examination and the dyspnea present attributed to the pressure of a large tumor. Pleurisy and effusions in the chest are by no means rare complications. Bronchitis is often made worse by the administration of an anesthetic, and may even cause death.

Emphysema and asthma should also be considered, as the embarrassed breathing, coughing, and deficient oxygenation render both operation and after-treatment difficult.

Heart Disease and Arterio-sclerosis.—In valvular disease, arterio-sclerosis, and all cases of arterial tension from any cause, the question to be decided is whether the cardio-vascular system will be able to stand the strain upon it. As long as compensation is well maintained, as indicated by general health, the area of cardiac dullness, and the force and rhythm of the pulse, minor degrees of valvular disease are of no particular moment. Failure in compensation, as shown by impaired circulation in the extremities, difficulty in breathing on exertion, attacks of dyspnea, diffuse, feeble, or irregular pulse indicating dilatation must be carefully noted, in order that the patient may be closely watched and unusual care taken in the administration of the anesthetic. I lost one case in this way; the patient was extremely cyanosed and suffered from a great dyspnea throughout the operation, from which she never recovered (see Chapter XXVI, Vol. II). Where there is excessive arterial tension, an attempt may be made to correct this previous to operation by methods of elimination or the administration of a vaso-dilator.

In all cases of painful menstruation and menorrhagia the heart must be carefully examined, as these disabilities may be associated with valvular diseases and venous stasis. One of the most important and serious affections is disease of the coronary arteries, liable to cause sudden death in the midst of an apparently perfect convalescence. Arterio-sclerosis, with its weakened vascular system, must be noted, as it holds a definite relation to the repair of wounds, making vessels difficult to control and increasing the risks of secondary hemorrhage.

Affections of the Alimentary Canal.—Dyspepsia must be looked for together with its associated ailments, headache, depression, and nausea. Graver affections of the alimentary tract, such as aggravated forms of dyspepsia, gastric ulcer, and dysentery, are associated with depraved nutrition and demand close attention. A possible cancer of the stomach needs consideration. I have several times had such patients come to me for gynecological treatment.

Constipation is perhaps the commonest ailment associated with these affections; it is important to note its degree and the means habitually adopted by the patient to relieve it.

Diseases of the Liver.—In examining the right hypochondrium, cirrhosis, cancer, and abscess of the liver must be borne in mind. The palpating fingers should also always try to touch the gall bladder. I have several times found this enlarged. In one case of large papilloma of the ovary, the gall bladder was as big as the fist, distended with a cement-like substance. In another, with a dense fibroid weighing forty-nine pounds, much pain was felt in a nodule on the right on top of the tumor. I decided that this was the gall bladder, and, at the removal of the tumor, opened the gall bladder, letting out a quantity of pus and removing a stone.

Diseases of the Kidney.—The examination of the kidneys and their function must be more carefully conducted than that of any other extra-pelvic organ. They are the emunctories whose activity is most important after any operation, and on account of the intimate association of the ureters with the uterus, ovaries, and tubes, their function may be seriously impaired when these organs are diseased. The presence of albumin, of casts, and of pus, as well as the amount of urea excreted must always be inquired into.

Diabetes is such a serious complication that it must be looked for in every instance.

TAKING THE HISTORY.

An accurate history of a case can not always be obtained at the first consultation, as nervous women frequently give such indefinite answers that it is best to leave some parts to be written at a future visit. I think it is a good plan to allow the patient to begin by describing her condition without plying any questions. During the recital the general appearance of the patient, her habit, complexion, temperament, peculiarities of manner or of conversation, and any other points which may have a bearing on her case should be noted. By associating this general view with the general physical examination, the gynecologist is able to form a better estimate of the possibilities of partial relief or of complete cure.

After the patient has talked awhile, if she inclines to wander and be indefinite and trivial, I do not hesitate to interrupt with certain routine questions. To this end I find a skeleton outline in my case book invaluable in keeping important headings constantly in view. I insert a facsimile of one of the pages. As far as possible it is filled in at the first visit. It is important to note in every gynecological history the presence of a variety of associated ailments cited in the list, which may have a bearing in one way or another upon the pelvic affection.

Further, to avoid pursuing an aimless or indefinite line of treatment, I always record an outline of the course to be pursued in each case after a thorough examination. It is only by doing this that palliative measures may be tested satisfactorily, associated functional disorders relieved, and the patient placed in the best possible condition for an operation. For example, I note in a case of myoma of the uterus in which the patient is debilitated the following *régime*: "Rest in bed, with massage and electricity on alternate days; careful diet, largely liquid; regulation of bowels; when patient is sufficiently built up, the tumor to be removed by abdominal hystero-myomectomy."

A diagram representing the relations and lesions of the pelvic organs should accompany the history, for even if the sketch be a rough one, it often furnishes a more definite idea of the case at a later date than the elaborate description.

It is a good plan for the busy surgeon to take a careful history of the case and then, while he has the history and the results of his examination clearly in mind, to fill out on a printed form a list of those features of the case which he thinks may need further investigation before operation; on this list he also indicates the exact nature of the operation, or operations he proposes to perform. By this method he is sure to avoid overlooking any important

Date *Diagnosis*

Name *S. W. M.* *Age* *Resides*

Occupation *Par.* *Miscarriages* *Patient of Dr.*

Instr. deliv. *fever*

Menstr. hist. *Gen. appearance*

Weight

Headaches

Leucor. *Sleep.*

Complains now of the following symptoms *Appetite*

Digestion

Bowels

Float. kid.

Urination

Urinary analysis

History of development of present condition

Bladder

Rectum

General previous hist. *rheumatism* *fevers, etc.*

Family history

SKETCH

PHYSICAL EXAM. OF PELVIS AND ABDOMEN

Vag. outlet

Vagina

Cervix

Uterus

Uterine tubes and ovaries

Outline of treatment to be followed

ninaries, and he is also sure, not only to do the operation manifestly
l for in this case, but not to neglect certain other minor operations which
ften indicated, and which, if left undone, sometimes cause great dissatis-
on to the patient. The operations most apt to be overlooked when asso-
l with other surgical affections are, suspension of the kidney, removal
e vermiform appendix, a laceration of the cervix, and hemorrhoids. I
out a slip like the following, which is brought to the operating room
the patient, and greatly facilitates my work, besides preventing mistakes
oversights:

FURTHER TREATMENT PROPOSED.

Date

STIGATE FIRST:

Heart and Lungs

Stomach Anal.

Urine

Kidneys

Blood

ATIONS:

Abd.

Pelv.

V. A.

Renal

Rect.

RKS:

There are four outlines necessary to illustrate properly the pelvis and its contents; Professor Schultze, of Jena, and Dr. R. L. Dickinson, of this country, have devised rubber stamps by means of which a diagrammatic view of several

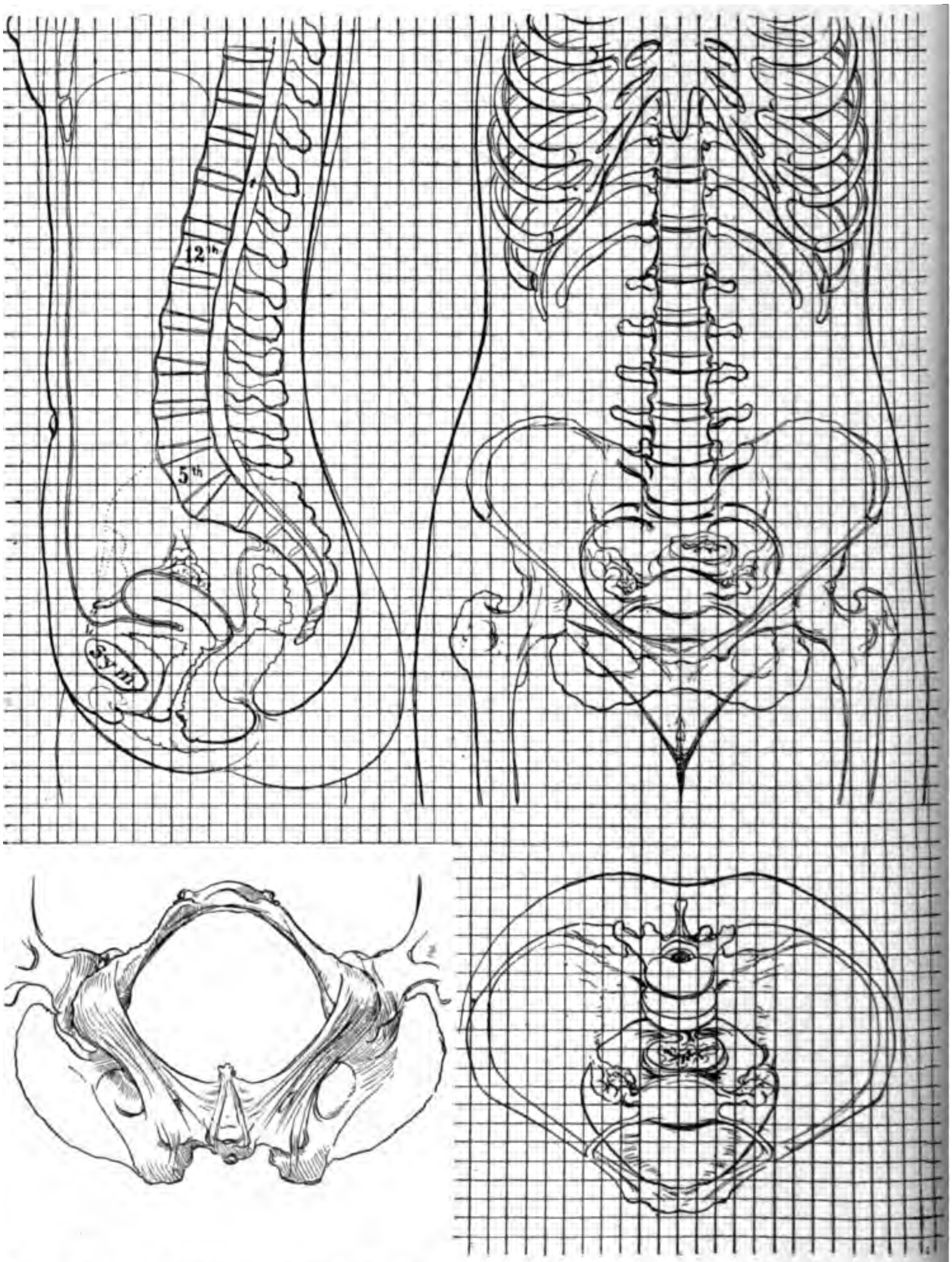


FIG. 74.—THE FOUR CARDINAL PROJECTIONS OF THE ABDOMEN AND PELVIS, REDUCED ON THE SAME SCALE.

Any point in the abdomen can be located by following the parallel lines in the three projections. The lower diagrams are viewed perpendicularly to the plane of the superior strait.

aspects of the pelvis can be reproduced in a case book, or upon a history blank. I prefer in some instances, however, to make a free-hand drawing, because individual peculiarities can be best brought out in this way. A sagittal section is used to indicate uterine displacements and the position of tumors in front of or behind the uterus.

A coronal section through the crests of the ilia, the acetabula, and the tuberosities of the ischium is necessary to demonstrate lateral displacements of the uterus and the location of inflammatory masses on the right and on the left. If the examination is unsatisfactory, and there is doubt concerning the existence of disease on either side, an interrogation mark indicates that the question is unsettled, and leaves it open for future determination in an examination under anesthesia.

Lesions lateral or posterior to the uterus, in order to be properly indicated diagrammatically, require an outline of the pelvis looking in from above. Such a diagram is especially valuable for filling in after operation, because by it the exact position and relationship of inflammatory masses to the pelvic organs can be graphically shown. Adhesions are conveniently indicated by zigzag or straight lines.

Areas of resistance in the vault of the vagina, not clearly outlined bimanually, are best registered on a diagram of the inferior strait, seen from below. Fig. 74 shows the three geometrical projections of the normal body: first, a sagittal section, viewed perpendicularly to the cut surface; second, a front view of the body, seen perpendicularly to its long axis; and third, a view of the pelvis from above and perpendicular to the superior strait. These diagrams have been drawn on the same scale and are covered by a double system of parallel lines, thus dividing each of the three projections into a certain number of squares, which have their corresponding fellows on the other projections. In other words, the body has been imagined divided into a system of cubes, the projections of which we see in the three planes as a square network. The ourth diagram, in the left lower corner of the plate, is a view of the inferior trait seen from below. It is evident that by following this system every iven point, or a tumor, in the body can be registered with great accuracy, as llustrated in Fig. 75, where the position of an ovarian cyst has been located its three dimensions.

The location of abdominal tumors and dull and tympanitic areas may be dicated on a large diagrammatic outline of the abdomen. In Fig. 76, on the ft, the abdomen is shown in outline with its contained viscera, and those rgans from which abdominal tumors most frequently develop are seen distribted around the periphery; in Fig. 76, on the right, is a diagrammatic illusration of the directions taken by the various abdominal tumors in the course f their development, as indicated by the arrows. These directions, as will be een, are centripetal—that is to say, from the more resisting periphery to the more yielding center.

The enlarging mass projecting toward the center in this way has a corona of resonance, with a dull base at its point of origin. Tumors of the omentum as indicated by the circular arrow, are surrounded on all sides by an area o resonance.

The characteristic difference in the location of upper and lower abdomina tumors is one which appeals at once to the eye, as shown in Fig. 77, drawn

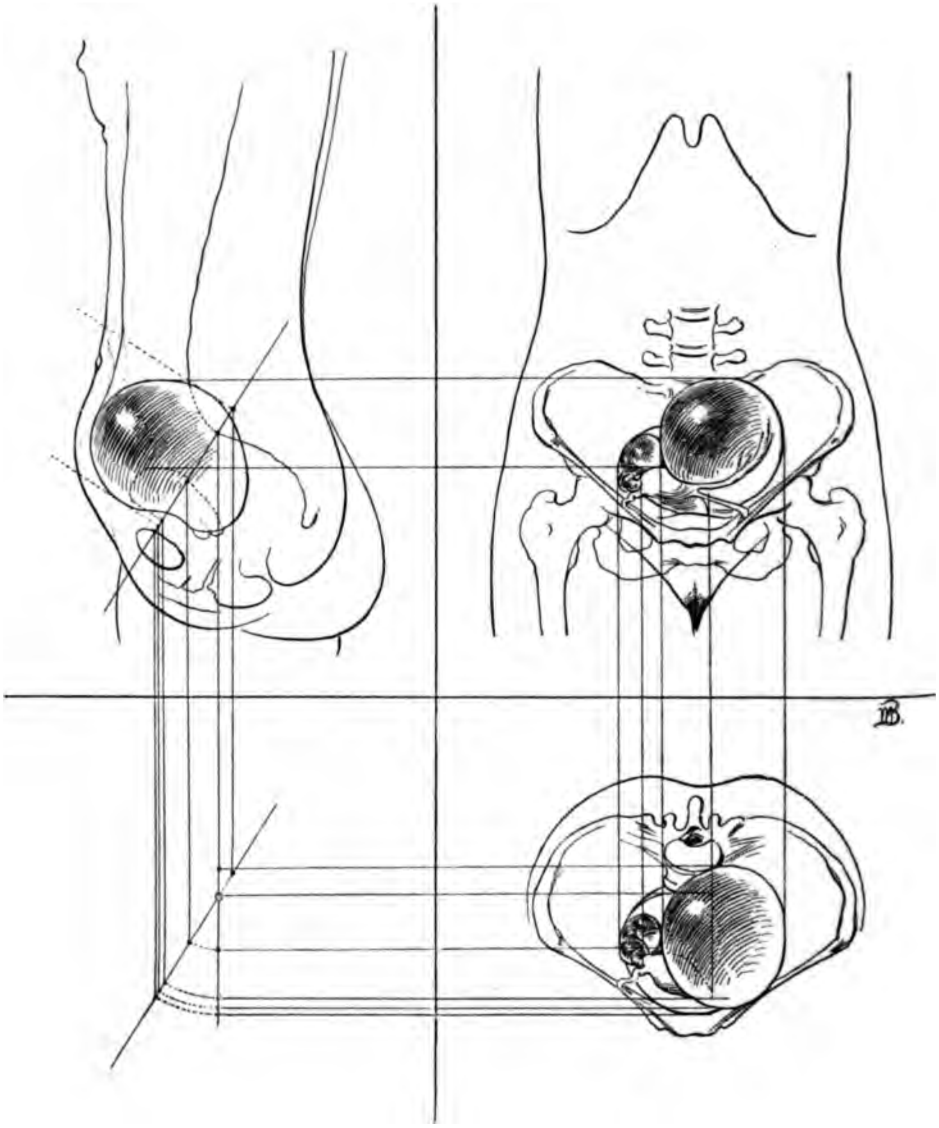


FIG. 75.—DIAGRAM SHOWING HOW TO USE THE PROJECTIONS OF FIG. 74 IN THE CASE OF A PELVIC TUMOR, ACCURATELY LOCATING IT AND REGISTERING ITS FORM.

from life, in a case of enormous accumulation of feces in the transverse colon; due to carcinoma of the uterus and rectum (*M. R.*, *op.*, July 29, '96).

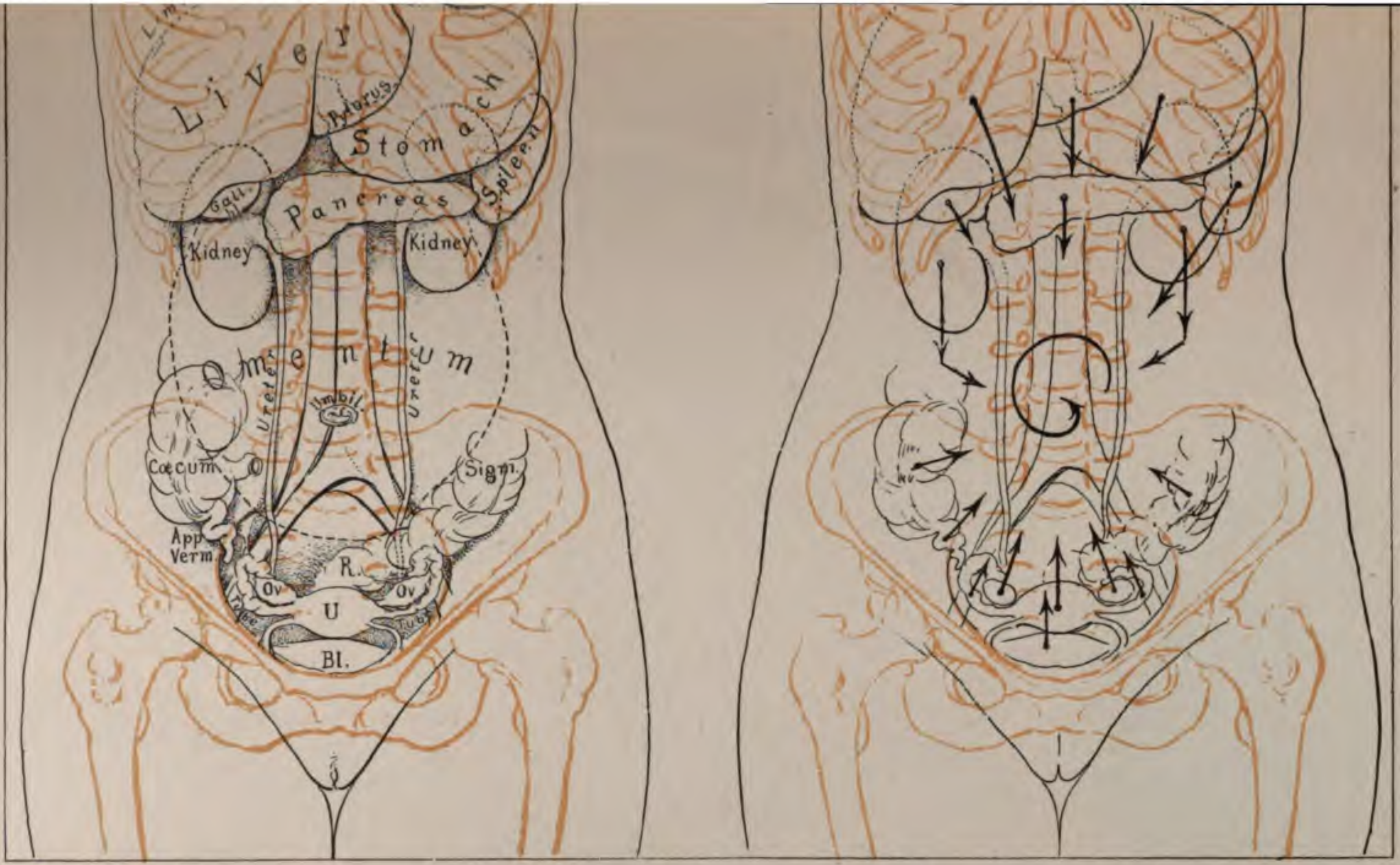


FIG. 76.—The left-hand figure shows in outline, situated about the periphery, the various important abdominal organs from which tumors may arise. In the right-hand figure, the arrows indicate the directions taken by these tumors from the periphery toward the center, where the resistance is least. (See p. 135.)

Before closing this subject I wish to urge the importance of minuter investigations, so as to bring out prominently the individual features. To the unscientific surgeon all cases are roughly classified under a few heads; one ovarian tumor is the same as another, except in size, and a prolapsus is a prolapsus, and nothing more. A closer scrutiny, however, will always bring out an infinite variety of individual differences, and attention to these, in time serves to shed light upon the causes of disease.

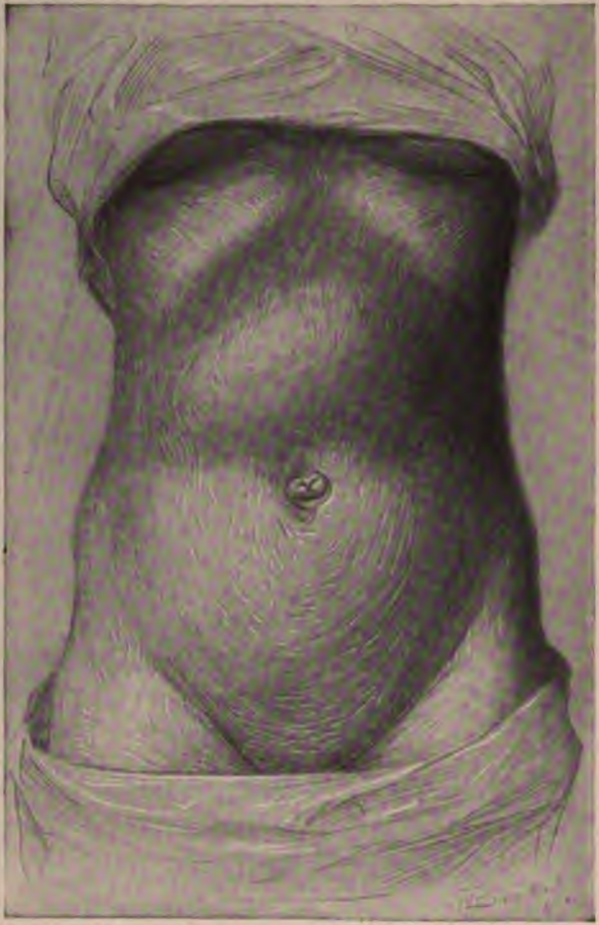


FIG. 77.—TUMOR EXTENDING TRANSVERSELY ACROSS THE UPPER ABDOMEN JUST ABOVE THE UMBILICUS, DUE TO A LARGE ACCUMULATION OF FECES IN THE TRANSVERSE COLON, FROM A CARCINOMA OF THE RECTUM AND UTERUS. RESONANCE ON ALL SIDES. M. R., oper., July 29, '96.

To illustrate, in a relaxed vaginal outlet the following questions ought to be answered: The exact degree of the relaxation, the amount of protrusion of the vaginal walls, the condition of the levator fibers as felt through the vagina, the increase of the protrusion at the outlet on straining while standing, the difference in the degree of relaxation produced by anesthesia, the tendency to prolapse; while the history should note the number and character of the labors (whether instrumental or natural) and the size of the children. Careful measurements should also be made with a pelvimeter to demonstrate whether difficult labors have been due to a contracted pelvis. All sorts of reflex disturbances ought also to be put down.

CHAPTER VI.

GYNECOLOGICAL INSTRUMENTS AND DRESSINGS.

1. Introduction (p. 139).
2. Illumination (p. 139).
3. Specula (p. 140): Nelson's trivalve speculum. Goodell-Baer bivalve speculum. Kelly's small cylindrical specula for virgins. Sims' speculum. Simon's speculum.
4. Retractors, vaginal and abdominal (p. 140).
5. Knives (p. 140): Ordinary scalpel. Broad-bladed scalpel, with a large handle.
6. Scissors (p. 140): Straight, sharp-pointed, and blunt. Emmet's left-curved scissors.
7. Tenacula (p. 141): Straight. Curved. Corrugated. Shepherd's crook.
8. Forceps (p. 141): Tenaculum forceps. Long straight dressing forceps. Long rat-toothed forceps. Rat-toothed dissecting forceps. Hemostatic forceps. Sponge forceps. Polyp forceps.
9. Ligature and suture materials (p. 144): Silk in three sizes—fine, medium, and stout. Silkworm gut. Catgut. Kangaroo tendon. Silver wire. Tying knots with silk and catgut.
10. Needles (p. 146): Curved and straight. Carrier. Needle holder. Transfixion needles.
11. Packer (p. 147).
12. Glass catheter (p. 148).
13. Large glass trocars (curved and pointed) for tapping cysts (p. 148).
14. Leg holder (p. 148).
15. Aspirator (p. 148): Dieulafoy-Potain aspirator. Syringe aspirator.
16. Cautery (p. 149): Paquelin's thermo-cautery. Electro-cautery.

A LARGE, carefully selected armamentarium is essential to the gynecologist. He needs instruments of three sorts:

(1) Instruments for exposing the field of operation in vagina or abdomen.

(2) Instruments for special operations.

(3) Instruments and accessories for closing the wound.

The field of the operation is often remote from the surface, either deep down on the pelvic floor or at the vaginal vault, and necessitates the use of specula and retractors to make it accessible. But specula are useless without a good light well directed upon the field; for this reason I will consider first the prime requisite—illumination.

The Illumination.—For the illumination of the field of operation, a good diffused sunlight is best of all. This is attained in the operating room by plenty of windows and a large skylight, as well as by walls painted with a light color. The direct rays of the sun are embarrassing, and so a north exposure s best. No operator, however, can afford to depend on this source of light alone, on account of the uncertainties of the weather and the frequent call for n intense illumination localized at one point.

In an emergency in private practice a common candle with a tin reflector, r a mirror held so as to direct its rays, may be used. In the clinic the electric ght is the best artificial illuminant. The current may be conducted from a all bracket by a long, insulated, flexible wire to the 16-candle-power lamp, with a tin reflector enameled white inside and attached to a handle. This can be held by an assistant so as effectively to illuminate the wound area. A simple extemporized reflector may be made by enclosing the electric light in a cone of white paper covered with black cloth. Where an electric street current is not available, a storage battery is a satisfactory substitute, running a 6- or 8-candle-power lamp.

Specula.—For inspection of the vaginal vault the best specula are Nelson's trivalve speculum, Goodell's bivalve speculum, modified by B. F. Baer, and Kelly's small cylindrical specula, Nos. 12–15 of the cystoscopic set, for use in the virgin. The utility of these instruments is limited to an examination for diagnostic purposes, to treatments applied to the vaginal vault, and to the application of packings. Sims' and Simon's specula are useful both in making an examination and in exposing the field during an operation at the vaginal vault, serving the double purpose of specula and retractors. The Sims speculum is most used by the New York school of gynecologists; it is more serviceable with the patient in the left lateral position. Several sizes are needed, differing in length and breadth, for narrow and relaxed, and for long and short vaginas. The Simon specula are purchased in sets, and consist of two handles with adjustable blades of varying lengths and breadths, for both the anterior and the posterior vaginal walls. They are used in the dorsal position.

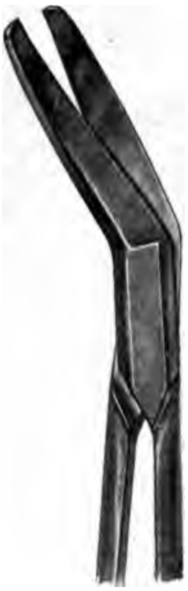


Fig. 78.—Emmet's Left-curved Scissors for Plastic Operations at the Vaginal Outlet.

Vaginal retractors, with long, light handles, are used to hold back the lateral and upper walls of the vagina, and to keep the field of operation free. The blades of these retractors should be of two sizes—2 by 7 cm. and 3 by 7 cm.

Abdominal retractors serve to lift up or to draw aside one of the walls on either side of an abdominal incision to enable the operator to inspect the pelvic viscera. The best patterns are Halsted's, with concave blades, 4 by 7 and 6 by 7 cm. in size.

Knives.—The knives used in gynecological surgery are the ordinary scalpels, made of solid metal, with handles smooth or grooved to afford a better grasp. For opening the abdomen, I like a broad-bladed scalpel with a large handle, and for marking areas of denudation in the vagina or on the cervix, or for delicate dissections in the pelvis, I prefer a knife with a slender blade and a sharp point.

In transporting or sterilizing knives, the blades must be wrapped in cotton, or they must be fastened in a rack in a metal box to protect them.

Scissors.—Scissors are among the most important of all gynecological instruments, and through the inventive genius and teaching of Dr. T. A. Emmet, of New York, they have come to be so widely used in this country as to cona characteristic feature of American gynecology. Straight and curved are used—the straight scissors for all ordinary cutting, and the curved in making denudations. Two pair of straight scissors are useful—rp-pointed, with a cutting edge 5½ cm. long and handles 14 cm. long, ioving sutures, cutting ligatures, aking short, straight incisions; er pair are blunt-pointed, with a edge of 7 cm. and a handle 18 length, for enlarging the abdomiision, for cutting the pedicles of and for excising thick areas of Large scissors angled on the e also used in extending the ab-l incision.

met's left-curved scissors (Fig. e invaluable in making denuda-1 the vagina, but it is necessary that these scissors have a good and that they cut evenly from r to end.

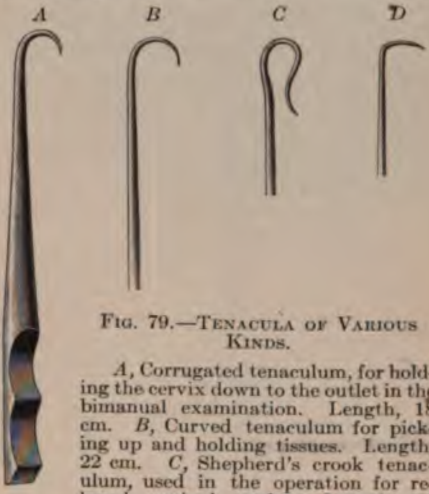


Fig. 79.—Tenacula of Various Kinds.

A, Corrugated tenaculum, for holding the cervix down to the outlet in the bimanual examination. Length, 18 cm. *B*, Curved tenaculum for picking up and holding tissues. Length, 22 cm. *C*, Shepherd's crook tenaculum, used in the operation for relaxed vaginal outlet. Length, 21 cm. *D*, Right-angled tenaculum used in turning in the edges of the tissues in approximation by suture. Length, 19 cm.

acula. — Tenacula are used to ind hold movable tissues which ig sutured, to steady the cervix uteri, and to catch bleeding vessels down pelvis and lift them up while a ligature is being applied; but the um has not the importance now that it had some years ago (Fig. 79). re are two varieties of tenacula—the straight and the curved. The t tenaculum, *D*, is employed in tucking in and in approximating tissue outs out of an incision while it is being sutured, as well as in catching ll areas of tissue which are to be trimmed off with knife and scissors. rved tenacula are of three kinds: the simple curved, B, the corrugated, the shepherd's crook, *C*. The simple curved tenaculum is used to catch which is to be firmly held; the hooked end keeps it from slipping off. rrugated tenaculum serves as a tractor to bring the uterus down for ation. My shepherd's crook tenaculum is used in the operation for ion of the vaginal outlet. After this tenaculum is once put in place it dropped repeatedly without losing its hold on the tissue.

ceps.—Under this name are classified a variety of instruments differing in use and construction, but having one common end in view—that of g and holding tissues.

following kinds of forceps are used in gynecological surgery:

iaculum forceps.
ig, straight dressing forceps.
ig rat-toothed forceps.
t-toothed dissecting forceps.
Hemostatic forceps.
Sponge forceps.
Polyp forceps.

Tenaculum forceps, or double tenaculum forceps, resemble two tenacula fastened so as to work together in opposite directions. They are used to grasp and draw the cervix down, to steady it while the uterine dilator is introduced, and to catch and hold a bleeding pedicle which has dropped back into the abdomen. They ought to be made strong enough to resist feathering, and the ends must be slightly curved at right angles to the shaft and tapered, as shown in the figure, to prevent tearing the tissues. The figure (Fig. 80) shows a small tenaculum forceps which I have found especially useful. If the tenaculum tears out, a three-pronged tenaculum may be used to advantage (Fig. 81).

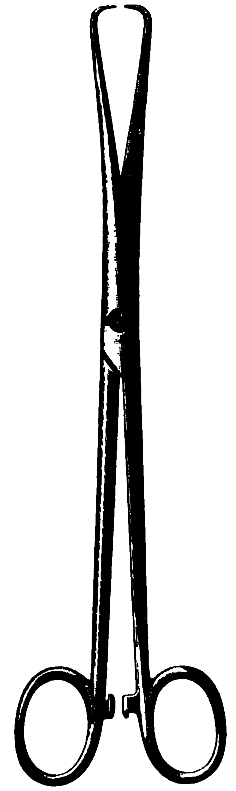


Fig. 80.—Tenaculum Forceps, with Catch and Open Lock. Half ordinary size.

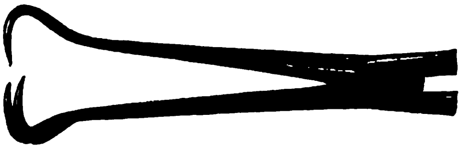


Fig. 81.—Cullen's Three-pronged Tenaculum Forceps for holding down the Cervix Uteri. Actual size.

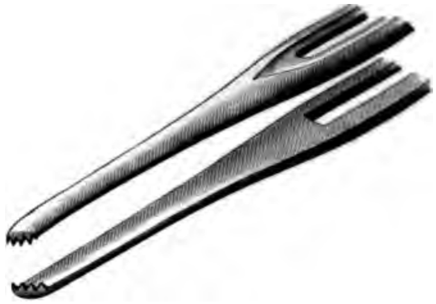


Fig. 82.—End of Large Rat-toothed Forcep for use deep in the Pelvis. Whole lengt 23 cm.

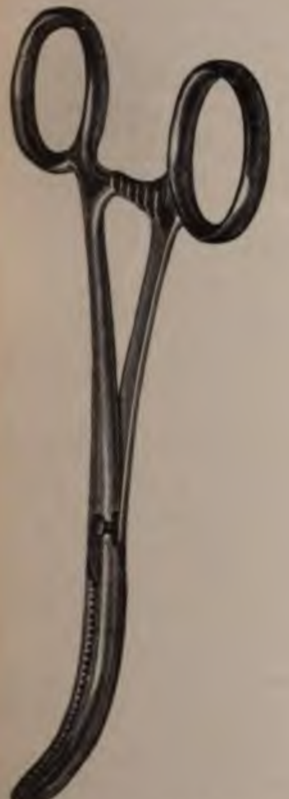
Long, straight dressing forceps are constantly used in removing and applyin dressings, in carrying pledgets of cotton into the vagina to cleanse it, and i making applications.

Long Rat-toothed Forceps.—I find a pair of long rat-toothed forceps, lik those described in the text (Fig. 82), one of my most useful instruments i abdominal surgery, effectually taking the place of a hand deep down in t pelvis.

Rat-toothed dissecting forceps are needed in picking up the layers of tissu in making the abdominal incision, and in catching the tissue in vaginal an cervical denudations.

Hemostatic Forceps.—At least two dozen artery forceps should be include in a set of abdominal instruments, but only four sets are required for mos vaginal operations. The original forceps were devised by Koeberlé, of Strass burg, and are excellent for the compression of vessels lying in soft tissues, as in the abdominal walls and on the floor of the vagina. For general use the forceps figured in the text, which are in use in the Johns Hopkins Hospital, are the most satisfactory (Fig. 83). They are 15 cm. in length, and have a curved biting surface 4 cm. long; the lock shown in the figure is an improvement on my own lock. The especial points of value in these forceps are (1) that the jaws are longer than usual and gently curved, and (2) that the tips of the jaws grasp the tissue before the first shoulder is reached. This permits a small bit of tissue or an artery to be clamped by the points if the forceps are only closed one or two notches, while a large area may be clamped if they are closed completely.

Sponge Forceps or Holders.—Sponges in abdominal surgery are chiefly of service in cleansing the pelvic cavity, in taking up pus rapidly, and in holding back the intestines. The best sponge holder is my own, with a lock devised by Dr. G. B. Miller, of the gynecological staff of the Johns Hopkins Hospital, and shown in the accompanying figures (Fig. 84). The essential features of these forceps are the blunt teeth at the lower end which hold the sponge, and



IG. 83.—Hemostatic Forceps with Open Lock.

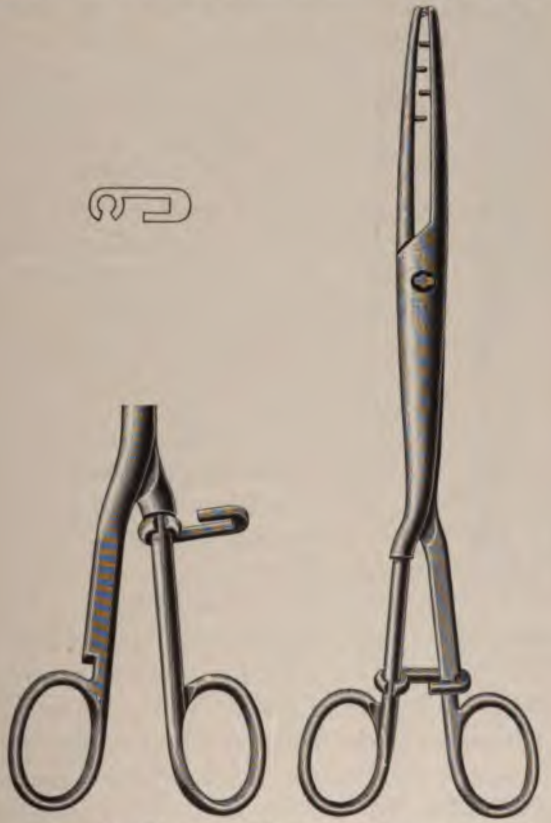


Fig. 84.—Miller's Sponge Forceps.

The hook shown above in outline, hangs loose on the round handle until the forceps are locked, as seen in the right-hand figure.

the clasp which slides freely under one handle until it is slipped over the neck of the other handle and pushed down, fixing the sponge. The entire length of the forceps is 22.5 cm., and the whole separates into three pieces for cleansing.

Polyp Forceps.—The best forceps for grasping small polyps or for removing a small ovum or pieces of placenta are those shown in the text (Fig. 85). The form of the blade is shown in the figure, and the handles are 27.5 cm. long and provided with a catch.

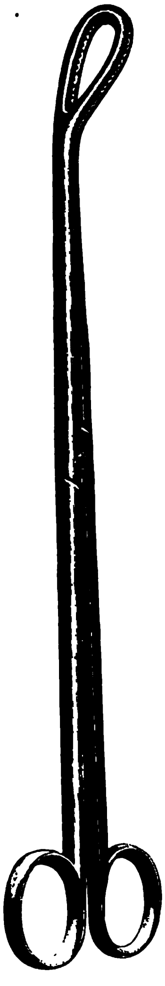


FIG. 85.—PLACENTA AND POLYP FORCEPS. LENGTH, 30.5 CM.

The ligature and suture materials used in gynecology are silk, silkworm gut, catgut, and silver wire, which are conveniently abbreviated in clinical records by using the initial letters only before the word "suture," as s., s. w. g., c. g., s. w. sutures.

Silk.—Pure Chinese silk is used in three sizes—fine, medium, and coarse.

Fine silk is best adapted for the ligation of small vessels, for suturing the intestines, for approximating peritoneal surfaces, and for bringing wound surfaces into apposition when there is no tension.

Medium silk is used in ligating large vessels and in tying off the ovarian vessels in a bunch. This size should always be used in preference to heavier silk in all cases where it can stand the strain.

Coarse silk ligatures should only be used in vaginal hysterectomy in tying off the broad ligaments. Coarse silk ligatures are also used as tractors to pull the uterus down in vaginal hysterectomy.

Silkworm gut is one of the best plastic suture materials we have, and once introduced and tied, or clamped with shot, preserves a well-rounded, elastic loop indefinitely, or until it is removed. The fact that it possesses no meshes gives it a great advantage over silk, which in time forms a seton, furnishing a highway of communication for germs from the surface into the deeper tissues. Silkworm gut is rarely used as a buried suture, either in the abdominal cavity or in the vagina. It is used by many surgeons in closing the abdominal wound after celiotomy, in cervical operations, and as a tension suture in the operation for relaxed vaginal outlet or lacerated perineum.

Catgut, properly sterilized, is valuable as ligature and suture material, because it is absorbed by the tissues and does not require removal. The chief objections to catgut are the difficulty of sterilizing it, its too rapid absorption, and the fact that it may come untied. Only intermediate and heavy-sized catgut should be used, as finer strands are too weak. Water swells and softens catgut so quickly that it must be kept immersed in alcohol until it is used. The too rapid absorption of catgut is prevented by its preparation in cumol (see Chapter I). In vaginal operations catgut is chiefly used as an accurate approximation suture; if it holds but four days, the tissues, as a rule, are sufficiently united, so that sutures are no longer necessary. Its greatest advantage here is that the removal of sutures is avoided.

Kangaroo tendon, the split sinews of the kangaroo's tail, introduced by Dr. Henry O. Marcy, of Boston, has the advantage of being absorbed much more slowly than catgut. It is useful in all forms of suturing and ligating, and Dr. Marcy advocates it especially for radical hernia operations.

Silver Wire.—Stout silver wire has been introduced by Dr. W. S. Halsted as a buried suture. Its chief use as a permanent suture is in holding together the fasciæ of the abdominal incision when it is closed, and in uniting the muscles and fasciæ in the radical cure for hernia. The wire is best introduced as a mattress suture, the ends twisted four times at an obtuse angle, cut off, and turned down at one side of the incision. These sutures remain indefinitely in place, and rarely have to be taken out, like buried sutures of silkworm gut.

Tying Knots with Silk and Catgut.—Much time may be lost by tying knots clumsily, and the surgeon will be a gainer all his life long if he will learn at the outset a definite, rapid method of tying both silk and catgut. Silkworm gut is best tied in a square knot, after immersion in warm water. Catgut is best tied dry or moistened but a little. If a third knot is added, either to the silkworm gut or the catgut, the ends may then be safely cut off close to the ligature; the use of a third knot leaves less foreign material behind, the knot is less liable to slip, and also, in the case of silkworm gut, the little ends, which are liable to irritate the tissue, are removed.

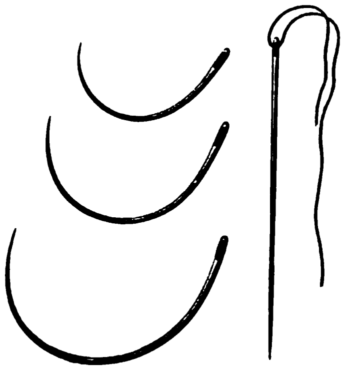


FIG. 86.—CURVED NEEDLES, 3 SIZES.

Used in plastic work and all kinds of suturing, except suture of the intestines. Straight straw needle, used in intestinal suturing, on the right.

Needles.—Curved needles (Fig. 86) are the best for almost all gynecological purposes; they should be of three sizes, as shown in the figure, and must answer the following requirements: A good temper, a good, open eye, a short straight shank just below the eye for the grasp of the needle holder, and a cutting surface not wider than the body of the needle; the point must follow the curve of the needle, and must not be bent inward. One of the commonest faults is a kink or a curve just below the eye, making the needle liable to break in the grasp of the holder. Simple, straight cambric needles, with a round sharp point, and without any cutting edge, are the best for intestinal suturing; they are held in the fingers so that the sense of resistance at the point may enable the operator to recognize the position of the submucous fibrous coat, and so to pick it up.

The Suture Carrier.—The suture carrier is a silk loop tied to the eye of a needle for the purpose of pulling interrupted sutures through in rapid succession. It is tied by taking a long piece of medium silk 52 cm. (21 inches) long, putting both ends together through the eye of a needle, and then making a loop on one of the ends, slipping it over the needle beyond the eye, and pulling it tight (Figs. 87 and 88). The length of the carrier loop made in this way is 20 cm. (8 inches) long. In using the carrier the needle is passed through the tissue, and when the loop, threaded by the assistant, is drawn through, the suture is in place. Sutures may be placed more rapidly in this way than by any other means. The intestinal needles are each armed with a single thread of fine black silk. The carrier is never used in intestinal sutures, in order to avoid making any larger hole than is absolutely necessary.

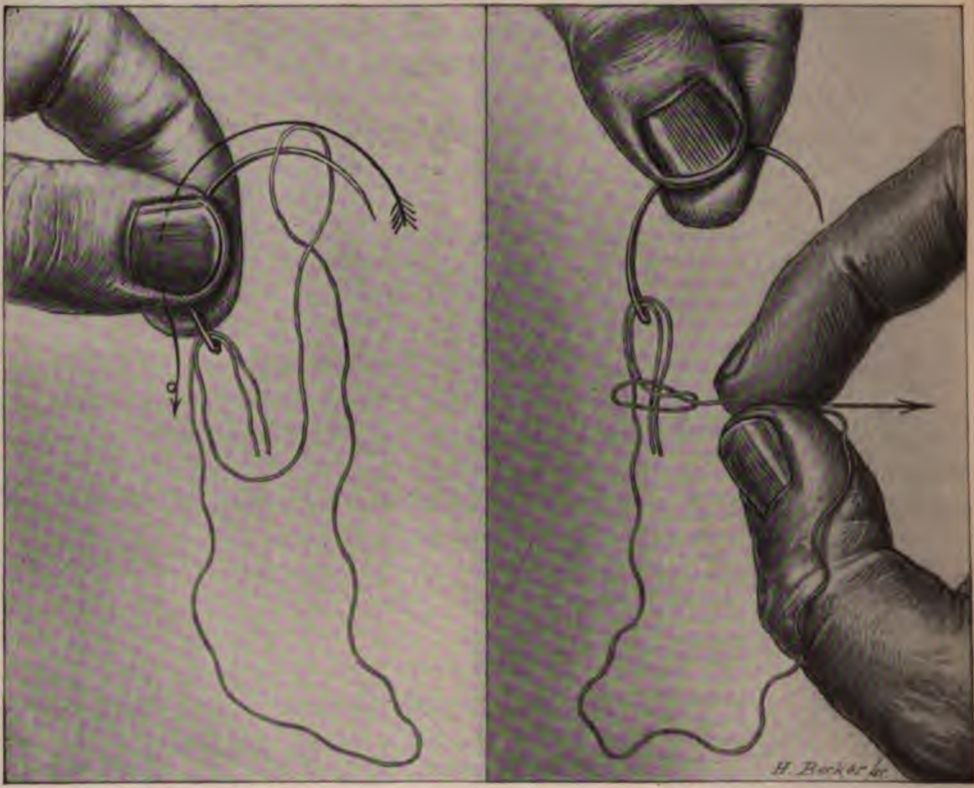

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FIG. 87. FIG. 88.

First and second steps in making the silk carrier. Both ends of the thread are put through the eye of the needle in the same direction, and a loop is formed passing over the needle in the direction of the arrow, as shown in Fig. 87; the loop is then brought down below the eye and drawn tight, fixing the carrier as shown in Fig. 88.

Needle Holder.—The most satisfactory needle holder for curved needles is the one figured here (Figs. 89 and 90).

It is important that the handles should be large enough to afford a good grip, that the catch should work easily and smoothly, and that the end which holds the needle should be narrow, well tapered, and copper-faced.

Transfixion Needles.—Transfixion needles are used to carry stout ligatures through the broad ligament in vaginal hysterectomy. The important requisites are a big handle for a convenient grasp, a stout shank which will not bend, and a well-curved end with a big eye just behind a point neither sharp nor very blunt. I only use the needle curved from right to left.

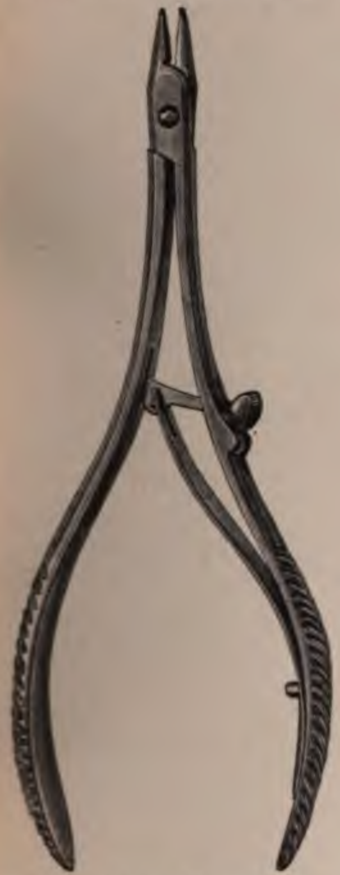


FIG. 89.—NEEDLE FORCEPS FOR CURVED NEEDLES. $\frac{2}{3}$ ORDINARY SIZE.

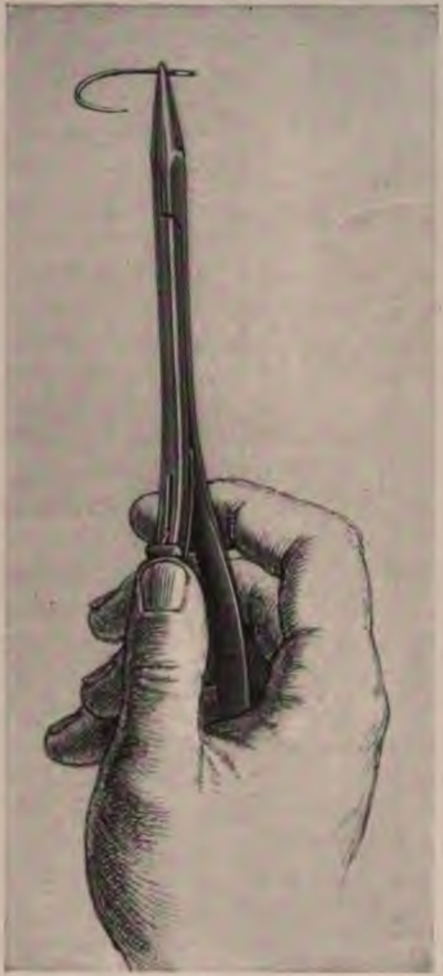


FIG. 90.—NEEDLE FORCEPS SHOWING THE SHAPE OF THE BITE AND THE MANNER OF GRASPING THE NEEDLE ON THE FLAT PART JUST BELOW THE EYE.

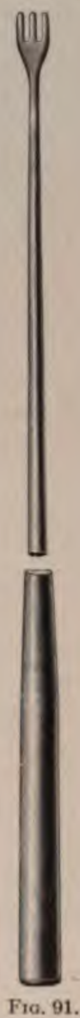


FIG. 91.

PACKER FOR PLACING COTTON OR GAUZE IN POSITION. LENGTH, 20.5 CM.

Packer.—A three-pronged packer, modeled like a miniature, blunt pitchfork, is valuable in introducing dressings into the vagina and in arranging properly a gauze drain in the abdomen. It is also used in packing cotton, wool, or gauze against the vaginal vault while the patient is in the left lateral semiprone position (Fig. 91).

Glass Catheters.—Short glass catheters should supersede the metal ones for women, as they are so easily made aseptic and kept clean by immersion in a carbolic or boric acid solution. There is no danger of the catheter breaking while being used, if it is not cracked when introduced. The catheter measures 13 cm. in length and 5 mm. in diameter. It is gently curved in opposite directions at the ends, and there is a large eye on each side near the end, as well as a small hole at the end, to facilitate cleansing.

Trocars. The Large Glass Trocars for tapping Cysts.—For the evacuation of large ovarian cysts I use only glass trocars, curved at one end and pointed at the other, with large fenestræ on both sides, near the pointed end. The end of the trocar beyond the fenestræ is closed by a glass partition to prevent dirt lodging there, while the discharging end has a collar over which the rubber tube is slipped. The clear glass discloses the slightest trace of dirt and renders it possible to sterilize these instruments much more satisfactorily than the metal trocars.

Leg Holder.—In operations requiring the lithotomy position it is necessary to use some kind of a leg holder to retain the legs flexed and drawn upon the abdomen out of the way during the operation. My own leg holder, or Robb's modification of it, is the simplest form both for use and for transportation. The holder is composed of three parts: two canvas rings which are put on the thighs just above the knees, and a broad canvas strap which goes from one loop to the other around the neck. The rings are made of two thicknesses of heavy canton flannel quilted together. The ring is widest below, where the greatest pressure comes, being 13 cm. (5 inches) in width, and narrowest on top, 2½ cm. (1 inch) in width, where a galvanized ring is placed to hold the neck strap. The canvas rings should be 50 cm. (20 inches) in circumference. The neck strap is made of a double canvas quilted like the loops, 89 cm. (35 inches) in length, and 6½ cm. (2½ inches) wider in the middle, gradually tapering to the ends. Harness straps at the ends and three metal rings about 15 cm. apart make the leg holder adjustable.

Aspirator.—The aspirator, at one time largely given up, has in recent years again become an indispensable instrument. The Dieulafoy-Potain aspirator is one of the best, and is so well known as to need no description. During the operation the aspirator should be in the hands of a competent assistant, who should be sure that the bottle is well exhausted and the suction channel unobstructed before use. Immediately after using the instrument the suction tube should be cleansed by creating a vacuum in the bottle and immersing the point in warm water. The tubing, after being washed out in this way, should be placed in a bichloride solution (1 1,000) for at least an hour, after which it is dried and put away in the case. The needles and trocars should be sterilized after every operation by boiling in a carbonate of sodium solution (1 per cent) for five minutes, and dried in a Bunsen or an alcohol flame. The receiving bottle should be sterile, as it is often desirable to make cultures from its contents.

ge Aspirator.—My own aspirator is like a large glass syringe, a pint ity, with a metal point to which a piece of rubber tubing, with a needle, ed. The piston must fit perfectly to keep the air from entering. A nd an opening on the side provide for the discharge of the contents arrel without withdrawing the trocar.

ery.—The term cautery is used in contrast to chemical cauterization by nitric acid, chloride of zinc, nitrate of silver, caustic potash, etc. irons of ancient surgery have been replaced in modern times by 's thermo-cautery or one of its modifications, too familiar to need ion. One of the best forms is that in which the tube passes directly the middle of a small bottle holding the benzine.

Electro-cautery.—In the clinic room an electro-cautery is often more nt than the thermo-cautery. The electricity is supplied from a storage or, better still, from a street current which is cut down. I use in my alternating current controller, in which induction is used for resist- place of a sectional coil and point switch. A 52-volt alternating cur- employed and reduced by the controller from 0 to 5 volts with an e of from 1 to 35.

CHAPTER VII.

LOCAL AND PALLIATIVE TREATMENTS.

1. Vaginitis (p. 150): Douches. Tampons.
2. Endocervicitis (p. 153).
3. Pelvic inflammation (p. 154): Spa treatment.

FIFTY years ago the gynecologist rarely operated, and, as a rule, he included both obstetrics and the diseases of children within the domain of his specialty. But with the advent of such men as Sims, Emmet, and Bozeman in America, Spencer Wells, Keith, and Tait in Great Britain, Simon and Schroeder in Germany, with Koeberlé and Pean in France, the operative field in gynecology widened and the gynecologist became, at the same time, more and more of a surgeon. As the development of gynecology proceeded, its surgical requirements increased, while the range of subjects included within its domain diminished until, in our own day, it has become distinctly specialized and almost exclusively surgical—I am inclined to think too surgical. For, when the risks and discomforts following operation are as slight as they have now become, the temptation to advise the more specious radical course is always present.

I hope that gynecologists are destined to do still better work within the next decade, and I believe that this improvement will be associated with greater caution in undertaking operations, together with a return to the use of many of those local and palliative treatments which were tested and found valuable in the hands of our predecessors. For this reason I would recommend a careful re-reading of the works of such men as West, Bennett, Duncan, Meigs, Hodge, and others.

The most common of the morbid conditions requiring local treatment the hands of the gynecologist are, vaginitis, endocervicitis, and pelvi inflammatory thickenings.

Vaginitis.—This condition, which is characterized by a milky discharge, by one more or less purulent, is usually treated by medicated douches of vario kinds, or by the prolonged injection of hot water, for a period of ten to fifte minutes, at a temperature of 115° to 120° F.

Douches.—The protracted hot douche is much used whenever there pelvic pain, or in cases of mild peritoneal inflammation. Its use sometim affords temporary relief from pain and is, therefore, most grateful to the patie For this reason it is a valuable remedy, although I am not aware that in it it is ever actually curative, either in vaginitis or in pelvic peritonitis. I m say the same thing of the medicated douches, which serve to suppress the sig of vaginal inflammation so long as they are used from day to day, by removi the secretions which are an indication of it, but as soon as the douches are suspended, the discharge at once reappears.

Alum, bicarbonate of soda, and borax, a teaspoonful of each to a pint of water is a readily made douche. A pinch of permanganate of potash in a pint of water, in proportion sufficient to make a 2 to 3 per cent solution, is valuable. I also find the following formula very satisfactory:

℞ Sodium borate	gr. xii
Sodium bi-carb.	gr. xii
Menthol	gr. i
Alum	gr. ii

M. Ft. Compressed tablet No. I.

The menthol makes a cooling and agreeable addition; about one drop to the pint is sufficient. Carbolic acid (one per cent), and bichloride of mercury (1-5,000) are often useful. It is a good practice to vary the solution used from time to time. Each of the douches mentioned has its advantages, and I can not lay down any special rule for the choice of one solution rather than another. When small quantities of water, that is to say a pint or a quart, are used, it is best to dissolve the powder in hot water and then let the solution stand until it becomes tepid, when it can be used. There is no advantage in using very hot water in small quantities. A rubber bag, raised about two feet above the level of the patient, who is in the reclining posture, and a slightly curved glass nozzle which can be boiled, is, perhaps, the best means of administering a douche. I do not know that there is any special benefit to be derived from the more laborious method involved in using a douche with a bulb which is compressed by hand so as to give an intermittent jet.

Tampons.—These, which are much in vogue, are used with two ends in view: (1) As convenient carriers of some medicament; (2) for the purpose of distending the vagina and of affording an elastic support to the uterus. Patients who become accustomed to this kind of artificial support, and, in especial, those who are in the habit of inserting the tampon themselves, often find it difficult to dispense with its use. The tampon habit is a bad one, for the tampon, *per se*, never cures any disease of any kind; nevertheless, the tampon may be used as a temporizing measure, while keeping the patient under observation.

The various tampons in use are all made of absorbent cotton, wool, or gauze strips, and the medicaments most serviceable on a tampon are boroglycerid and ichthyol. Absorbent cotton is the best carrier of a drug, while wool gives the better elastic support. A good way of applying the tampon is to take a pledget of the absorbent cotton, and after making a little nest in it, to pour into this a teaspoonful or a dessertspoonful of boroglycerid, or of a ten per cent solution of ichthyol with a little glycerin added. The cotton is then folded and conveyed to the vault of the vagina by a pair of dressing forceps, and underneath the cotton is placed an elastic wool pack to hold it snugly in place. When a tampon is applied in a lax vagina, it is important to see that the cervix is well up in place before its insertion. If the cervix crowds down when the patient is in the dorsal position, it will certainly drop up into the lower abdomen when she is put in the knee-chest posture. The latter posture is especially useful in the insertion of a firm pack. In some cases the vaginal vault is best exposed by a trivalve speculum, such as Nelson's, with the patient in the dorsal position; in others, Sims' speculum and Sims' position are best. It is the usual custom to request the patient to remove the tampon herself and then to use a douche daily until her next visit to the physician's office, and in such cases each piece of the tampon must be fastened to a thread or a narrow tape, the end of which is left hanging outside for the purpose. No tampon ought to be left in the vagina over forty-eight hours, lest it should become foul. Berry Hart and others advise making the application on a tampon by means of a narrow strip of absorbent cotton eight or ten inches long.

I often make topical vaginal applications by means of a long strip of gauze, from an inch to an inch and a half wide, and from two to three feet long, which is saturated with ichthyol or with a 10 to 20 per cent solution of argyrol. A saturated pack of this kind is best transferred directly from a little porcelain dish held close to the patient and carried up into the vagina by means of a two-pronged packer. Care must be exercised to avoid using so much of the solution that the excess will escape upon the clothing. A perineal pad should always be worn afterwards as a protection, especially when nitrate of silver has been used. I often follow up these argyrol treatments by requesting the patient to return to the office on alternate days, when I remove the pack, cleanse the vagina, and insert a fresh pack.

The treatment I prefer for an aggravated or a persistent vaginitis, or for a vaginitis of the senile variety is, first to secure complete exposure of th entire vagina, with the patient in the knee-chest position, by raising th perineum with Sims' speculum, or using a tubular metal speculum with large handle, and then carefully painting the entire surface with a 30 to 4 per cent solution of nitrate of silver. This procedure whitens the walls and by destroying the superficial epithelium, exposes the deeper layers, bringin away a cast of the vagina within a few days. This treatment should be fo lowed by a mild course of packing (argyrol five to ten per cent) repeated, i necessary, in about two weeks. For senile vaginitis especially, I know of n better treatment.

The tampon is sometimes put to valuable use by making it serve the p pose of locating the source of a vaginal discharge (Schultze's *Probe Tampon* A colored cotton serves this purpose best. The vagina is carefully pack with the patient on her side; if this is done in the evening the pack may removed in from twelve to twenty-four hours. Each piece is examined as is removed, and in this way the source of the greatest discharge can be asc tained. It is a good plan to keep the patient in bed during this investigatio Schultze recommends the use of tannic acid in glycerin on the cotton in or to coagulate the discharge and render it more easily recognizable.

Endocervicitis.—This condition is characterized by a glairy, albuminous, mucoid, or muco-purulent discharge. The methods in use to-day are, as a rule, inadequate to cure this deep-seated and most obstinate affection.

In bad cases it is often best to amputate the cervix, dissecting out the mucous membrane, turning in the vaginal mucosa, and uniting them by means of interrupted sutures. Our predecessors were wont, in these cases, apparently in desperation, to place a stick of solid nitrate of silver, or *potassa fusa*, in the cervical canal, and to leave it there. Undoubtedly they thus, as a rule, effected a radical cure of a most troublesome affection, but not infrequently with a resultant densely cicatricial and stenosed cervix.

I recommend heartily a plan of treatment originating with my associate, Dr. Guy L. Hunner, but also practiced, on the authority of Berry Hart, by Lawson Tait, which has proved entirely satisfactory in Dr. Hunner's hands, as well as in my own. I refer to the use of the actual cautery, by which means most cases can be cured, and that, too, in the course of several treatments, given in the office. Only occasionally is it necessary to employ one of the brief anesthetics, in the case of nervous women who are more afraid of the idea of cauterization than of actual pain, which is scarcely, if at all, felt.

The method of application is as follows: The cervix is exposed, with the patient in the lithotomy position, by means of a trivalve speculum (I like Nelson's, of Chicago, best), the anterior lip of the cervix is caught with a tenaculum or a vulsella forceps and drawn down a little. Next, the canal is cleansed of its tenacious secretions by means of peroxide of hydrogen (the cleansing, however, is not really essential), the Paquelin cautery with its knife-blade heated to an intense red is then quickly carried well up into the cervical canal as far as the os internum. Dr. Hunner prefers to make several, say three, linear cauterizations at equal intervals by drawing the knife-blade down with its edge pressing into the diseased tissues. This does well for the office treatment which may have to be repeated once or twice, at intervals of about three weeks. I have often gone so far, especially if an anesthetic is given, as to burn out the entire cervical canal at one sitting. I have never seen any ill result follow this, seemingly, most aggressive and radical treatment. It is well to warn the patient that she will suffer from an increased discharge, often tinged with blood for ten to twelve days. A douche of menthol and soda or of weak carbolic acid solution should be prescribed for the intervals between the treatments. This method is successful in some of the most obstinate cases; in one case a patient who had been in my hands for years was promptly cured by it.

Craig, of Boston, treats these cases with eminent success in an even simpler way. He grasps the cervix firmly by the anterior lip so as to fix it, and hen dilates the lower cervical canal with a short conical dilator having a flange which keeps it from entering more than three-quarters of an inch. This opens he canal for the introduction of a triangular sharp-edged curette, by means of hich the canal is vigorously curetted, the orifice of the glands broken open, nd some tissue removed. This treatment is promptly effective.

Pelvic Inflammation.—An acute pelvic inflammation, not puerperal in origin, if attended with a persistent elevation of temperature and a well-defined swelling at the vaginal vault, is best treated, when a competent surgeon is at hand, by a free incision into the peritoneum with drainage (Henrotin). In a subacute affection the best plan of treatment is rest in bed, limited diet, thorough evacuation of the bowels, and hot saline vaginal douches repeated two or three times daily for ten to fifteen minutes at a time. As long as there is any continued tenderness about the vaginal vault the rest should be continued and the utmost that ought to be done locally is to paint the vaginal vault with a strong tincture of iodine (Churchill's) every two or three days, associated with a boroglycerid pack. If the tenderness persists and any enlargement can be detected, the advisability of posterior incision and drainage should be considered. I can not state with any positive conviction that painting the vaginal vault is of any real service, but it is a line of treatment which was extensively used by the older gynecologists, and I employ it occasionally myself in deference to their judgment. In subacute cases of this kind it was the practice of the late George Engelmann to apply a pack of non-absorbent cotton-wool coated with vaseline and well sprinkled with boric acid powder.

Spa Treatment.—Where the affection is of a mild nature and the nervous element predominates, surgical methods are not advisable, and a course of treatment at a spa may be of the utmost benefit. The advantages of a spa are not, as I apprehend, due to any particular medicated waters imbibed there, but rather to a complete change of air and scene, and to the stimulus of a regular life and regimen consisting of walks and drives, diversion, and systematic prescribed hours of repose, to which the patient gladly conforms. The business of the place is "getting well," and to the above-cited adjuvants there is added that most potent of all remedies—the tonic effect of a definite expectation of improvement. I would also note for the benefit of the wise physician that the entire separation from family cares and responsibilities of house and children, and, most of all in many cases, from husband, are of capital importance. Friction, electricity, and the stimulus of carbonic acid baths to the skin to promote elimination and stimulate the nerves into healthy activity are also often of use in aiding recovery.

The wise and interested physician will see that under circumstances in which it is not possible for the patient to leave home, he can still contrive to secure some of the benefits of a change by altering the routine of home life; this is done by ordering breakfast taken in bed, hot and cold sponge baths, and out-of-door exercises, as well as certain hours of seclusion and rest, and, in many cases, by seeing that a nervous patient sleeps in her own bed alone and undisturbed.

By dint of unfailing patience and watchful care many cases where there is no gross lesion and in which the patients would be hurt, not helped, by operation, can be tided over a period of ill health and made sound useful members of the family life and society once more.

CHAPTER VIII.

MENSTRUATION AND ITS ANOMALIES.

1. Dysmenorrhea (p. 155): Forms and causes. Treatment.
2. Amenorrhea (p. 165): Forms and causes. Treatment.
3. Menorrhagia and Metrorrhagia (p. 169): Forms and causes. Treatment.

DYSMENORRHEA.

It should be stated at the outset that our knowledge of dysmenorrhea is purely empirical and that the theories offered to account for it as well as the practices adopted to relieve it, are based upon experience and conjecture, not upon any scientific analysis of those still mysterious causes to which this "functional" disorder owes its existence.

The molimina of normal menstruation are made up of both local and general manifestations, which appear, in general, a few hours and, less frequently, a few days before the flow, being most severe on the first day. They consist of a sensation of weight or "fulness" in the lower abdomen and pelvis, dull pains in the back, and a general lassitude with disinclination to exertion. Slight headache is often present, with nausea and increased nervous irritability. These discomforts are experienced by most women, to a greater or less extent, although a woman in ideal health ought to know no difference between the menstrual and intermenstrual periods.

In dysmenorrhea the menstrual discomfort is of such severity that it may be considered pathological in comparison with the moderate amount of suffering usually experienced. No sharp line can be drawn between the common, bearable, menstrual discomforts and the pain of dysmenorrhea. If the pain is sufficient to elicit decided complaint, or to compel the patient to alter her customary daily routine to any marked degree, it may be classified as dysmenorrhea.

From the standpoint of the subjective symptoms, dysmenorrhea may be divided into two classes. In the first group the character of the menstrual discomfort is identical with that usually considered physiological, except that the pain is much more severe. In the second group the suffering is not only severe, but it is of a different character from that commonly experienced.

In the class of cases characterized simply by exaggerated suffering, the onset of the latter is usually from one or two days to a week before the appearance of the flow and is manifested as dull abdominal or lumbar pains. The distress is often relieved when the flow appears, but it sometimes continues through the whole period, and even for a few days longer. It is of a dull, dragging, bearing-down nature, situated on one or both sides of the lower abdomen, and often extending to the back or legs. Severe headache, nausea and vomiting, extreme lassitude, and marked nervous irritability are frequent accompaniments.

In the second group of cases, where the pain is of a different type, it is sharp, rhythmic, and cramp-like or spasmodic. The paroxysms come on at intervals and last but a minute or two. The recumbent position is not so apt to bring relief as in the first group of cases. Usually, the symptoms appear a few hours before the flow and disappear when it is well established. Some dysmenorrheas present both types of pain, the sharp, griping colics being superadded to the dull, persistent aching, and the two are present in varying proportion.

FORMS AND CAUSES OF DYSMENORRHEA.

Many explanations have been advanced to account for dysmenorrhea, the most widely accepted being as follows:

Mechanical Theory.—This theory, which presupposes a constriction or coarctation of the uterine canal, that impedes the escape of the menstrual products, was first advanced by Dr. John Mackintosh, of Edinburgh, who treated it by using the straight metallic bougies to effect a dilatation (Hart and Barbour). The constriction, or obstruction theory was accepted and developed by Marion Sims, Sir James Y. Simpson, and many of their contemporaries, as well as by some of the later writers, and if we are to judge by the extent to which it is followed in practice this theory is more generally accepted than any other. It explains dysmenorrhea by assuming that an obstruction is present in the uterine cervix, and that the uterus contracts as the fluid accumulates in order to force the blood past the obstacle, the contractions being subjectively realized in the form of uterine colic and constituting the pain of dysmenorrhea. The obstruction in question may be due to: (1) A kink in the cervical canal owing to an anteflexion, or, more rarely, a retroflexion; (2) a stenosis at the internal os, which may be congenital, or may be due to spasmodic contraction of the circular muscle fibers at the internal os, or else the result of a premenstrual swelling of the mucosa; (3) a congenital stenosis of the external os, or of the entire cervical canal; (4) intra-uterine polyps, acting as ball-valves; (5) clots of blood, or (in membranous dysmenorrhea) a membrane which is forced with difficulty through the internal os.

Maldevelopment Theory.—Dysmenorrhea is often associated with poorly developed pelvic organs, the relation between the two being, according to som observers, a neurosis; others claim that it arises from a deficiency in the calibe of the blood vessels, which are too small to receive the increased amount o blood necessary to establish the menstrual hyperemia; while others, again, consider it due to the fact that the uterine cavity is too small to accommodate th swollen endometrium. Still another view claims that in these cases the uteru is found anteflexed on account of the maldevelopment of its anterior surfac and the increased blood pressure tends to straighten the flexed organ, whi the resistance afforded by the lack of distensibility on the part of the uterine parenchyma occasions the pain.

Neurosis Theory.—In some cases the dysmenorrhea is undoubtedly a pure neurosis, to be explained as a hyperesthesia of the endometrium, or as an abnormal appreciation of the uterine contractions, which are physiologically present at every menstrual epoch, but not usually appreciable. It is conjectured that uterine colic is analogous to intestinal, being due to a tetanic spasm of circular muscular fibers at the internal os. The pain may also be due to a physiological difficulty occasioned by the breaking down of the mucous membrane associated with a persistent ineffective congestion of blood in the capillaries which induces a sort of pelvic headache.

Nasal Theory.—Fleiss, J. Mackenzie, and others look upon many dysmenorrheas as reflex neuroses, due to hyperesthesia of certain portions of the nasal tract. Cases of successful treatment by cocainizing these areas have been reported.

In addition to the theories cited, many other causes of dysmenorrhea have been brought forward. Chronic endometritis causing hyperesthesia of the endometrium is often noted. Perimetritis and perisalpingitis are sometimes undoubtedly responsible through peritoneal pain occasioned by contractions of the tubes or the uterus. One form of dysmenorrhea has been considered "neuralgic," to be classed with the neuroses as analogous to intercostal or facial neuralgia. Ovarian dysmenorrhea is sometimes seen associated with extreme sensitiveness of the ovary during the period, which can be demonstrated by digital pressure made upon it; it is explained by thickening of the ovarian capsule, which prevents the expansion of the ovary during the period of congestion. Dysmenorrhea is also sometimes of a gouty or a rheumatic character in women subject to these affections, and in some instances it is the only manifestation of the diathesis. Finally, dysmenorrhea is sometimes a secondary symptom of a gross pathological lesion of the pelvic organs. I would urge attention to the fact that small fibroids and pelvic peritonitis are often overlooked in the investigation of dysmenorrhea. Doubtful cases should always be examined minutely under an anesthetic, but if a single small fibroid is found, care must be exercised in promising relief from its removal. I have several times taken away the tumor and known the pain to continue.

The clinical features of many cases of dysmenorrhea seem undoubtedly fully accounted for at first by the mechanical theory. The pain is rhythmic and colicky; it comes on a few hours before the flow and gradually increases; the flow at first is scanty and then, as it becomes free, the distress grows gradually less until it finally ceases. According to the mechanical theory the obstruction has been overcome by increasing tension, and as the accumulated blood is forced out of the uterus the painful contractions cease. Support is given to this view by the fact that operations devised to overcome the obstruction frequently give relief. Closer examination of the facts, however, does not seem to increase our confidence in the theory. Vedeler (*Arch. f. Gynäk.*, 1883, Bd. 21, p. 211) has shown that out of a large number of women with anteflexed uteri, the percentage of those free from dysmenorrhea is as large as the percentage of those who suffer with it. It has been estimated that the amount of menstrual blood lost is one drop in three minutes, and it has been shown that menstrual blood easily flows at this rate through a tube much smaller than any possible stenosis of the os or the canal. (See also M. Duncan, "Clinical Lectures," p. 520, 4th edition.) It is true that we often meet with resistance when attempting to pass a uterine sound into the nulliparous uterus, but this does not necessarily indicate the presence of a pathological stenosis. Careful examination usually shows that the difficulty arises from the tip of the sound being caught in the folds of the mucosa, or from its encountering a flexure. A little additional manipulation carries the sound beyond the internal os with no further resistance. It has also been shown that during the acme of the pain, just before the flow appears, no blood is to be found in the uterus! In the case of uterine polyps the theory is beautiful and affords great satisfaction to the mind of the patient, but it is too easy of explanation and is not sustained by the facts. No doubt there may be veritable cases of mechanical dysmenorrhea, but they are not at all common, and in most cases to which the theory is applied, it does not cover the facts.

Maldevelopment of the pelvic organs is clearly an important causal factor in many instances of dysmenorrhea, although we are unable to explain precisely in what way it acts. We can only say, in general terms, that the incompletely developed organ is not capable of prompt efficient response to a normal impulse, so that it does not carry out its function with ease, and the pelvis is not relieved of its increased blood pressure, which, therefore, tends to become a stasis. The same thing may be said in regard to dysmenorrhea of the nervous type.

The question of nasal dysmenorrhea is not yet settled. The good results obtained by some observers from cocainizing the nasal mucous membrane are attributed by others solely to suggestion. As for chronic endometritis and chronic oöphoritis, they have not yet been demonstrated as etiological factors. In 64 cases of dysmenorrhea without any gross pathological lesion, treated in my own clinic by dilatation and curettage, chronic endometritis was found under the microscope in only four cases, and in no one of the four was the process marked. Ovarian dysmenorrhea associated with a thickened capsule or a chronic oöphoritis has not yet come under my observation. Dysmenorrhea of a rheumatic or gouty character has occasionally been demonstrated by the entire relief afforded from remedies appropriate to these conditions; this must alway be borne in mind in cases where there are other manifestations of the diathesis.

Dysmenorrhea as a Symptom of Abnormal Conditions of the Pelvic Organs.— Dysmenorrhea is often so associated with certain abnormal conditions of the pelvic organs that there can be no doubt it is sometimes induced by them. One of 1,000 patients, consecutively admitted to the Johns Hopkins Hospital, 229 suffered from dysmenorrhea which was apparently the direct result of a definite pelvic lesion. Many and various conditions of this kind may occasion dysmenorrhea, but it is most frequently caused by one of three lesions: (1) A backward displacement of the uterus; (2) a pelvic inflammatory disease; (3) a myoma. Of the 229 cases just mentioned, 41 per cent were associated with retrodisplacement of the uterus; 37 per cent with pelvic inflammatory disease; and 11 per cent with myomata.

Retroposition of the Uterus.—Dysmenorrhea is more constantly associated with retroposition of the uterus than with any other abnormal condition of the pelvic organs. In an analysis of nearly 450 cases of retroposition operated upon in my clinic, Dr. G. R. Holden showed that from 80 to 90 per cent of the nulliparæ suffered from dysmenorrhea (*Amer. Jour. Obs.*, 1905, vol. 51, p. 469). In retropositions occurring after labor, dysmenorrhea was much less frequently present, not more than one-quarter to one-third of such cases presenting it as a symptom. Dysmenorrhea is occasionally the only symptom caused by the displacement, but, usually, it is only one of a series of manifestations, although, perhaps, the most severe. There is no constant type of dysmenorrhea associated with retroposition; it is more apt to continue throughout the entire period, however, than the dysmenorrhea of nulliparæ, without a lesion. Gastric symptoms, headache, and other neurotic manifestations are often marked features, owing to the neurasthenia which almost invariably accompanies such cases.

Pelvic Inflammatory Disease.—About one-third of the acute or chronic inflammatory diseases of the uterus, tubes, and ovaries are accompanied by dysmenorrhea. The proportion of cases with menstrual pain is about the same in acute and chronic affections, and the intensity of the dysmenorrhea bears no relation to the extent of the pathological process. Cases in which the entire pelvic organs are the seat of extensive chronic inflammatory processes may have no dysmenorrhea whatever, while a few adhesions binding down lightly one tube and ovary may give rise to severe menstrual pain. As in the dysmenorrhea accompanying retroposition, there is no constant type of pain. The suffering usually comes on two or three days before the flow and lasts hroughout the period; most frequently it is dull in character and is often eferred to a wide area over the abdomen, back, and legs. Dysmenorrhea is casionally the only symptom. In acute salpingitis the symptoms often date om a menstrual period in which the suffering has been unusually severe; st frequently, however, the dysmenorrhea is only an acute exacerbation of e suffering previously experienced.

Myoma.—About 20 per cent of all cases of myoma suffer from dysmenor- a. It is most frequently seen with submucous and interstitial myomata, d is rare in the subperitoneal form. Severe dysmenorrhea is more frequently n with smaller tumors. There is no distinctive type of dysmenorrhea asso- ted with these conditions. Dysmenorrhea appearing in association with menorrhagia in a woman between thirty and forty years of age, is usually due to a uterine fibroid.

Other Pelvic Conditions Associated with Dysmenorrhea.—Ovarian tumors are of little etiological importance in relation to dysmenorrhea. A certain number of cases of floating kidney seem to have been associated with it, although the causal connection is not clear. The following case illustrates this group of cases:

Miss K. L. (San. No. 1468, November, 1902). The patient consulted me for an intense dysmenorrhea of years standing. The pain was accompanied by extreme nervousness and depression. Both kidneys were loose, and I demonstrated the relationship to the dysmenorrhea by passing a ureteral catheter up the right ureter into the pelvis of the kidney, when a few cubic centimeters of a sterile normal salt solution, gently injected through the catheter into the kidney pelvis, at once produced a severe attack of pain, exactly similar to that accompanying menstruation. I fixed both kidneys, and since the operation the pain is much less and entirely bearable, although it is still present to some extent.

Membranous Dysmenorrhea.—One of the most typical and remarkable forms of painful menstruation is that known as membranous dysmenorrhea. It is characterized by severe, labor-like pains which continue until the lining membrane of the uterus is expelled, either intact (which rarely happens) or in pieces. The pain appears to be due, in some measure, to the attempt to force the plug of tissue through the rigid resisting cervix. When the membrane is passed entire its nature can be readily distinguished by floating it in water; a shaggy outer coat can be seen, of narrow triangular form with little openings at the base corresponding to the tubal orifices, and a larger opening at the apex corresponding to the internal os. The little sac varies in thickness from 1 to 3 mm., and its inner surface, which is smoother than the outer, is somewhat furrowed. Microscopically the appearance is so typical that, as C. Gebhard asserts, it need not be confused with any other pathological process. The glands are diminished in number, areas of round cell infiltration are present in places, while the interglandular tissues show a finely granular exudate with blood elements here and there. The size of the stroma cells is characteristic, resembling, to some extent, the decidual cells of pregnancy (decidua menstrualis); the cells of pregnancy, however, are more numerous and a little broader. This condition must be distinguished from that known as endometritis menstrualis fibrinosa (see Schönheimer, *Arch. f. Gynäk.*, vol. 44, p. 304), in which fibrinous casts, dependent etiologically upon an inflammatory affection of the uterine mucosa, are formed in utero and extruded at each menstrual period.

Membranous dysmenorrhea comes on without, apparently, any predisposing cause, and is inexplicable in its etiology, appearing and then, it may be, disappearing uninfluenced by treatment. One of my cases, after passing a perfect cast from the uterus, acquired an extra-uterine pregnancy and passed a perfect decidual cast the following month.

Dysmenorrhea not Associated with Gross Pathological Change in the Pelvic Organs.—A dysmenorrhea not accompanied by any manifest local changes is usually a symptom attending some disturbance of general health. Many of the patients are girls in their teens, or young unmarried women. Maldevelopment, malnutrition, and anemia are the causal factors in a large number of cases, where the patients live in poor hygienic surroundings, and their mental and physical vigor are consequently far below par. Dysmenorrhea also often accompanies the first scanty menstruation after a protracted illness. Many of my cases have dated their sufferings from a typhoid fever from which they never entirely recovered. In the majority of such cases the patients are neurasthenics, and it is often hard to say whether the neurasthenia is the cause or the result of the dysmenorrhea, as the two conditions act and react, while the patient visibly declines in health.

A poor physical development is often associated with a similar condition of the pelvic organs, although maldevelopment of the pelvic organs is not necessarily associated with defective general development. Women in robust health, whose only ailment is dysmenorrhea, sometimes present imperfectly formed uteri and ovaries of the puerile type. In many such cases the maldevelopment is clearly the cause of the dysmenorrhea. There are, however, cases in which none of the above conditions are found. The women are not anemic, their physiological functions are well performed, and their organs normally developed, so that the dysmenorrhea must simply be put down as a neurosis whose exact nature can not be clearly defined.

In dysmenorrhea without pathological conditions of the pelvic organs, the character of the pain is not constant. In young girls it is most frequently of the spasmodic type.

TREATMENT OF DYSMENORRHEA.

An important question in the diagnosis and treatment of many cases of dysmenorrhea is the propriety of making a pelvic examination. There should, of course, be no hesitation in married women, or in cases which give a history indicative of inflammatory disease. But there are many cases of young unmarried women who complain of dysmenorrhea, pure and simple, when the question arises, What shall we do here? I am always very reluctant to make a first examination in a virgin, and I prefer to exhaust medical therapeutics and general treatments before doing so. If, however, the case is an aggravated one, or if it is persistent and can not remain under observation month after month, I propose an examination under an anesthetic. This spares the patient's feelings, and if due care is taken it can be done thoroughly, without, as a rule, rupturing the hymen, while at the same time any simple operation, such as a dilatation, can be done also. Such a course enables a physician to dispense with the endless local treatments which never do good under any circumstances. I wish that all my colleagues still held with Severinus Pinæus and the ancients: "*Magnum est crimen perrumpere virginis hymen.*"

Medical Treatment.—In all cases the closest attention must be paid to the general health. Constipation, anemia, malnutrition, neurasthenia, errors in diet and hygiene, should be watched and regulated persistently, for with the removal of these conditions a permanent relief of the dysmenorrhea may follow. Fresh air, exercise, diversion, and change of scene are often powerful adjuvants to the cure. The most important of all measures of relief is absolute rest in bed for two to three days at the time of the period, beginning just before its onset; entire relief is often purchased by this means.

For the relief of pain at the time of the period, dependence must be placed on mild analgesics, which should be dispensed by the physician, to guard against the formation of a habit induced by constant renewal of an old prescription. Such analgesics are: phenacetin and salol, aa gr. ii, every four to six hours for the first day or two; codeia, gr. ¼ every four hours; or my "dysmenorrhea mixture," composed of potassium bromide, gr. x, and the elixir of guarana and celery, fl. ʒij every four hours. Opium is always contraindicated, and the increasing tendency to seek relief in self-prescribed doses of "medicinal gin" or other alcoholics should, for obvious reasons, be strongly condemned. With many patients the latter remedy is a sovereign specific; as a Scotch woman put it to Berry Hart, "a good whack of gin and go to bed." Hot sitz baths and hot-water bags are popular remedies, often of considerable value. I find that relief is sometimes afforded by the administration of from 30 to 50 grains of bromide of potash or sodium in a pint of hot water, given by the rectum, with the onset of the pains, and repeated if necessary.

Dysmenorrhea associated with imperfect development of the pelvic organs is generally intractable and usually persists until the first pregnancy. After one labor it is generally relieved, and the stimulation of pregnancy seems to effect a normal development.

For membranous dysmenorrhea intra-uterine treatments of various kinds have been tried, but the results are unsatisfactory. Otherwise the treatment is that already described. Iodide of potash has been given and pushed, but rarely with advantage. The prognosis in this variety of dysmenorrhea is not good.

Operative Treatment.—Numerous operations upon the cervix have been devised to relieve dysmenorrhea. Whether the beneficial result of these operations is due to the relief of a stricture or to the destruction of the sensibility of the endometrium at the internal os, we do not know. It is a fact, however, that the dysmenorrhea is, in many instances, entirely relieved. Berry Hart suggests that the relief arises from the rupture of muscular fibers in the cervix and consequent destruction of contractility, much as relief is given by dilatation for fissure of the anus. Numerous cutting operations have been done, but the simple process of dilating the cervix, followed, if desirable, by curettage of the endometrium, seems to be as successful as any other procedure of the kind.

Dilatation and Curettage.—Dilatation is applicable only when no gross pathological lesion is present—an anteflexion not being considered pathological. If the dysmenorrhea is due to a retroflexion, dilatation will manifestly do no good so long as the malposition remains. One of my early cases illustrates the effect of a retrodisplacement upon menstruation.

Miss M. T. (J. H. H., Gyn. Nos. 2556 and 10283, 1894 and 1903). The patient complained of dysmenorrhea, and as examination under ether showed the pelvic organs entirely normal, I proceeded to dilate and curette. For eight years she had absolute relief from pain, but then the suffering returned, and in February, 1903, she came to me a second time. I now found a retrodisplacement of the uterus, to relieve which a suspension operation was done, and the dysmenorrhea was again entirely relieved.

In young women a retroflexion, if not acute and unassociated with a descensus, has, as a rule, nothing to do with the accompanying dysmenorrhea, and operation for the displacement ought to be a last resort. If it is done, the surgeon should always warn the patient that the correction of the deformity will not necessarily relieve the pain.

It sometimes happens that a case of chronic inflammatory disease of the pelvis, too slight to be recognized, undergoes an exacerbation after traction on the cervix, manipulation, dilatation, or curettage, and the old process is rekindled by the operative treatment. The result of such an oversight may be an immediate rise in temperature, accompanied by a typical attack of pelvic peritonitis, and surgeons do well to be on their guard against such an accident. Let me cite a suggestive case of another sort in which the slower evolution of the pelvic disease cleared up the diagnosis.

The patient (J. H. H., Gyn. No. 5995, April, 1898), a colored woman, twenty-nine years of age, had suffered from dysmenorrhea since her marriage, five years before her admission to my ward. With the advent of the dysmenorrhea a profuse and persistent leucorrhea began. At a careful examination under ether the pelvic organs appeared to be normal; dilatation and curettage were therefore done, and a few days afterwards she left the hospital. Eleven months later she returned, stating that she was worse than ever since the peration, the dysmenorrhea being greater than before, while she had also evere and constant abdominal pain. A second examination now showed a elvic peritonitis with extensive adhesions of both tubes and ovaries, for which was necessary to do a double salpingectomy and a left oöphorectomy. Here e had to do with a sneaking chronic inflammatory process, undoubtedly esent in the uterine tubes at the first operation, but not recognized.

Dilatation and curettage where the pelvic organs are normal yields the lowing percentage of satisfactory results: Out of 95 cases in my clinic, 18 re completely relieved with no subsequent return of the dysmenorrhea, and were greatly benefited, the pain never returning in its former severity; the iods of observation in these cases extended over one to twelve years. Of remainder, 7 cases were relieved, either completely or in great part, for periods varying from one to nine years, after which the dysmenorrhea returned. In 39 instances, therefore, out of 95, the results might be considered satisfactory. In 28 cases there was no relief at all, while the remaining 28 experienced more or less relief for a few months, but within a year, in every case, the suffering returned in the same severity as before. When the dysmenorrhea returns after many years or months of comfort, we are justified in recommending a second operation, and occasionally we find a patient who is regularly benefited by a thorough dilatation and curettage every few months, or once in a year or two.

There is no symptom-complex to designate the cases in which we may expect dilatation and curettage to be followed by good results, still we may, in general, anticipate relief in cases where the pain begins a few hours before the flow, is sharp in character, and lasts but a short time. A marked degree of neurasthenia does not necessarily forbid a good result, but if permanency of relief is to be secured, the neurasthenia must also be cured. An excellent plan in such cases is to institute a thorough rest cure begun by an ether examination and a curettage. Sometimes when all remedial measures fail, married life and pregnancy come in with their mysterious potency to accomplish in short order what years of artificial effort have failed to effect.

The operation may be done under a nitrous oxide anesthesia or under chloride of ethyl. The greater relaxation afforded by chloroform anesthesia affords a better opportunity for a minute examination of the various pelvic organs as well as for the dilatation. It is best, as a rule, to keep the patient in bed for a few days after the operation.

Suspension of the Uterus.—In cases of retrodisplacement, when other plans have been tried without success, suspension of the uterus becomes advisable. The constant dull pain occasioned by it, with periodically recurring crises, is sometimes responsible for a markedly neurasthenic condition. An operation is always preferable to a protracted course of local treatments. The use of pessaries associated with repeated examinations, manipulations, douches, etc., is always objectionable in unmarried women.

Other Operative Treatment.—In pelvic inflammatory diseases, dysmenorrhea may be the only symptom severe enough to necessitate operation. As a rule, however, it is but one of a syndrome of symptoms. The extent of operative interference will vary, of course, with the character and extent of the inflammatory process. Oöphorectomy, which is still, I fear, too often done for intractable dysmenorrhea, is rarely, if ever justifiable. Let the younger surgeon be assured that he may thus transform a neurotic invalid into a gloomy wreck, fitted only for an asylum, where she will be a reproach to his art to her dying day. Nothing is sadder than that he who comes to heal should injure, and that he should be responsible for the fact that "the after state of the patient is worse than the first." It is better that ten women should continue to endure periodical suffering for which he is not responsible than that he should cure nine and put one in an asylum.

AMENORRHEA.

Amenorrhea is a broad term used to designate a symptom common to a riety of affections, namely, an absence of the normal periodical menstrual ow. It often happens that this symptom is the particular manifestation of isease which calls the patient's attention to her condition, and just as a by- one generation divided defective vision into amblyopias and amauroses, ambly- pia being a condition in which the physician saw something and the patient othing, while in amaurosis neither patient nor physician saw anything, so e might now classify our amenorrheas into those with and those without a emonstrable cause.

In many cases where the symptom amenorrhea is the sole clue, the physi- an must work up, by means of it, through the maze of all possible causes, til he discovers the particular condition which is at work in the case under servation, and is able to decide whether the amenorrhea is physiological, velopmental, constitutional, mechanical, or, last of all, may I l, of that inexplicable class called functional. Let me here at the outset er a word of caution in regard to treatment under these circumstances. ere is, perhaps, no class of gynecological cases so trying to the skill and ience of the younger practitioner as these. The patient appeals to him to ieve, what seems to her, a very simple derangement, having heard repeatedly others similarly situated who were promptly relieved by a prescription or some slight local treatment. The physician, feeling that his success will a test of his skill, is prone to enter upon an energetic course of local and dicinal treatment in order to effect a cure and enhance his reputation. I uld urge upon him strongly that such cases often try the patience of the st practitioners, and that amenorrheas are preëminently a class of cases best ndled without meddlesome local treatment.

FORMS AND CAUSES OF AMENORRHEA.

Physiological.—Pregnancy is the great physiological cause of amenorrhea, d it must always be borne in mind, for unless it is kept first on the list a possible cause in every case, lamentable mistakes will be made, especially those who undertake an aggressive course of local treatment. In every case ere a young woman, previously regular in her courses, experiences an abrupt sation of menstruation without other easily demonstrable reason, pregnancy the presumptive cause. If the patient is married an examination should proposed at once, when the enlargement of the uterus corresponding to the iod of cessation will be found in all but the earliest cases. I need not ell here upon the other signs of pregnancy appearing as it undergoes evo- ion. Let me, however, call attention to one fact, especially noted by Dick- on, and which I have myself confirmed in many instances, namely, that the rus in the earliest stages of pregnancy is often gibbous, as though the ovum lodged and were developing in but one horn, which enlarges and softens, while the remainder remains hard and undeveloped. If a young woman applies to a physician for the relief of an amenorrhea, he may sometimes form a shrewd guess at the cause by suggesting an examination. If she readily accedes, there is a greater probability of a pregnancy than if she shrinks with natural modesty. Under the latter circumstances he is justified in deferring the examination until other, less extreme measures have been exhausted.

Lactation following pregnancy brings physiological relief from the additional tax of menstruation and calls for no investigation.

The Menopause, with the exhaustion of the function of ovulation, also brings a physiological relief from the cyclic menstrual changes, and this fact must be borne in mind in any case over forty years of age. Women are prone to assume that "the change of life is working" as early as thirty-five, or even earlier, but cessation of menstruation as soon as this is rare, and the physician should only accept it as a diagnosis after he has failed to find any other cause, and after the lapse of one or more years.

Developmental Amenorrhea.—This class of cases is caused by a puerile condition of the generative organs, or to a more or less extensive failure in development on the part of the vagina and uterus (aplasia and hypoplasia). Such a condition is rarely seen, although its existence is often assumed. It is to be suspected in the case of a patient in her teens who has never menstruated, and it is readily demonstrated by a local examination. In order to make a valid diagnosis of a puerile or undeveloped state of the uterus, the examiner must have clearly in mind the size and contour of the normal uterus, remembering that the organ is smaller in small women. The attenuated, undeveloped organ, with its small body and disproportionately long and large cervix, is characteristic.

Constitutional Amenorrhea.—Constitutional causes must always be borne in mind as exercising a profound influence over the menstrual function. Chlorosis is the commonest cause, and provokes great irregularity of the function as to time, amount of flow, and character of the discharge, which is often pale, pinkish, and of short duration. It soon ceases altogether, until the general health is restored by the use of tonics, especially iron, arsenic, and manganese. Blaud's pills are the favorite method of administering iron. They must be taken for two or three months, three times a day, the dose being gradually increased from one to two or three pills each time. The formula is as follows:

℞ Ferri sulph., Potas. carb.,	āā gr. ij.
Muc. tragacanth	q. s. ft. pil. i.

The trioxide of manganese may be given alone or combined with arsenic and iron in two grain pills three times a day. Equally important to the use of these tonics is the regulation of the bowels by means of such a prescription as is recommended by Hart and Barbour:

℞ Magnes. sulph.	℥j
Quin. sulph.	gr. xxiv
Acid. sulph. dil.	fʒiij
Aq. ad.	f℥vj

M. S.: f℥j twice or thrice daily.

The bitter is a valuable adjuvant to the purge. Natural saline waters are most useful, especially if taken at the spring.

Anemia will cause amenorrhea, and it frequently follows such constitutional affections as typhoid fever or other infectious diseases. It is also often seen in pulmonary phthisis, as well as in any other disease which profoundly affects the general health and nutrition.

Obesity is an extraordinary constitutional cause of amenorrhea. When a young woman who is much beyond the average weight notes an increase from month to month, and complains first of scanty menstruation and then of complete cessation, the physician will do well to direct his attention from the local symptom to the general condition.

Other constitutional causes of amenorrhea are: Myxedema, Acromegaly, Addison's Disease, Basedow's Disease, Progressive Paralysis, and certain chronic poisonings (C. Gebhard). Morphin, or opium in any form, used habitually have the effect of suppressing the function in time completely.

Mechanical Amenorrhea.—The causes in this class of cases are those which hinder the outflow of the menstrual secretion, such as atresia of the vagina or the cervix uteri. Suppression of the menstrual flow from this cause is not an amenorrhea in the true sense of the word, and might, perhaps, be better classed with dysmenorrhea.

Functional Amenorrhea.—In these cases a patient with normal generative organs and in average health ceases to menstruate without any objective local or constitutional cause which can be demonstrated. Excitement, a sudden shock, or an alarm will cause a period to cease, to be delayed, or missed altogether. The mere expectation of pregnancy is sometimes a sufficient cause. This particular complication is most common in the case of a young woman who having wrongly exposed herself to the risks of pregnancy, watches with great anxiety for the next period, and notes its non-appearance as the hours slip by with extreme alarm. It often happens, in such cases, that the succeeding period appears in a perfectly normal manner. The mere intense desire for pregnancy will sometimes bring it about and perpetuate the amenorrhea for months. Exposure to cold during a menstrual period, or even a cold bath, will suffice to induce a persistent amenorrhea in a person who does not react well. Overstudy brings about the same result. In other instances amenorrhea at irregular intervals, for which no definite reason can be given, is observed in young girls in whom the function is not yet fully established. Could we follow the evolution of the corpus luteum in all these cases we should undoubtedly be able to trace the causes of amenorrhea one step farther back in the causal chain.

Superinvolution following severe labor with hemorrhage is a fortunately rare cause, but it must always be borne in mind when a persistent amenorrhea is noted after labor.

II. Vineberg has drawn attention to the atrophy of the uterus due to prolonged lactation and the consequent amenorrhea.

TREATMENT OF AMENORRHEA.

A good general rule in the treatment of amenorrhea is that there is no occasion for rapid action, based on the adage "the more haste the less speed." No direct local treatment is suitable, except in cases of retention, which are really pseudo-amenorrheas. In this connection let me again reiterate the statement, endorsed by every practitioner of experience: Pregnancy must stand first in the etiology of amenorrhea, inscribed with the motto *noli me tangere* in burning letters.

In the case of young girls, when nothing suggests a developmental defect, the treatment should be local, not general; and it must always be remembered that in such cases the amenorrhea is never caused by a retroflexed uterus. In young girls the treatment should, first of all, be directed toward diverting the mind of the patient from the pelvic organs by assuring her that a little time and patience will regulate the function. If she is studying too hard at school, her work must be modified. One girl in good physical condition, living a normal life, is better than five girls with abnormally developed brains, whose lives revolve around their pelvic functions. Anemia in schoolgirls must receive the closest attention. Daily exercise in the open air must be insisted upon, and night study absolutely forbidden. *Verbum sapienti satis est.* Iron and manganese, with systematic unloading of the clogged bowels, are the prime factors, as before stated, in the management of the chlorotic form of amenorrhea. All opiates must be avoided, and if already in use, must be withdrawn. After fevers and other severe illnesses the absence of menstruation, while the system is recuperating, is a blessing, and the treatment is simply to exercise patience until health is reëstablished. Amenorrhea in consumptives should be let alone, and the patients treated for their major ailment.

In cases of superinvolution nothing can be done. In those due to arrested development, "galvanic" stem pessaries in the uterus have been used, but, I think, without the slightest reasonable claim to benefit. Many writers have boasted of the value of the electric current, constant or interrupted, the negative pole being applied inside (Apostoli). I am not prepared to utter a sweeping denial of these claims, and I am willing to concede that the method is perhaps worth a patient trial for a few weeks. The cathode, shaped like a sound, is introduced into the uterus, while the positive pole is applied outside.

Amenorrhea in nervous, neurasthenic patients is best treated by encouraging the patient as to her condition, assuring her that time alone is necessary for a cure, and advising her to make a suitable climatic change, associated with relief of mind as to domestic cares. As William Osler is wont to assure many of his patients: "Dr. Time is the best physician here."

MENORRHAGIA AND METRORRHAGIA.

Uterine hemorrhages are of two kinds: one of these, which is periodical, that is to say, associated with the normal menstrual flow, is called menorrhagia; the other, which is irregular and stands in no manifest relation to menstruation, is known as metrorrhagia. In some cases it is easy to use these terms with discrimination, but in others it is impossible to do so, because the two conditions coexist. Precisely the same affections give rise to both menorrhagia and metrorrhagia, as for example, incomplete abortion, cancer of the cervix or the body of the uterus, fibroid polyps, and extra-uterine pregnancy. It is plain, therefore, that it is not always necessary to be minutely particular in our efforts to classify any particular case under one or the other category.

Menorrhagia.—The question whether the menstrual flow is excessive is, to some extent, an individual one. The normal, habitual discharge of a plethoric woman might well be considered serious in one of slight build, with but little blood to spare. Each woman soon learns her personal norm, which she can readily bear, and realizes that if this is greatly exceeded for several successive periods her general health must suffer. The use of one or two napkins in twenty-four hours may be considered normal, although this, too, is largely dependent upon personal habits. A typical menorrhagia is constituted by excessive discharge, prolonged for several days beyond the customary period, and reacting unfavorably upon the general health. One form of menorrhagia is that in which the flow is very great for two or three days out of the period. We may say then that in a menorrhagia from two to three times the normal amount of blood is lost, coming away in spurts of bright blood or gushes, or accumulating in the vagina in large clots, which are discharged whenever the bladder is emptied. A notable characteristic of menorrhagia is that the flow increases when the patient is on her feet and going actively about. The amount of flow is, in some instances, enough to threaten life. The prolongation of the flow may extend over a period of any length, from a few days to the succeeding period, which may even be indistinguishable. We have, then, two types of menorrhagia, which can exist independently or conjointly:

1. A flow which is excessive throughout the period.
2. A flow which is unduly prolonged.

Menorrhagia of either type, when persistent, reacts upon the general health, inducing anemia, shortness of breath, and general weakness.

FORMS AND CAUSES OF MENORRHAGIA AND METRORRHAGIA.

The causes of menorrhagia and metrorrhagia are three: local, constitutional, and vascular. **Local causes,** or those present in the pelvis, are the following:

1. Threatened abortion.
2. Hypertrophy of the uterine mucosa.
3. Polypi.
4. Irregularity in the establishment of the menstrual function in young women.
5. Endometritis.
6. Submucous or pedunculate myomata.
7. Subinvolution of the uterus. Inversion of the uterus. Endocervicitis.
8. Sclerosis or atheroma of the uterine vessels.
9. Extra-uterine pregnancy.
10. Cancer of the cervix uteri.
11. Cancer of the fundus uteri.
12. Deciduoma uteri. Sarcoma uteri.
13. Large cystic ovaries.
14. Malignant ovarian tumors.
15. Any inflammatory condition of the tubes or pelvic peritoneum.
16. Appendicitis.

The **constitutional causes** are:

1. Anemia, especially pernicious anemia.
2. A rheumatic diathesis.
3. Scurvy.
4. Phthisis.
5. A variety of infectious diseases.

Causes lying in the **vascular system** are notably:

1. Cardiac disease which creates a vascular stasis, especially mitral regurgitation.
2. Hepatic disease which creates a portal stasis, as, for example, cirrhosis. This cause is especially seen in alcoholics.
3. Cases in which no demonstrable cause exists (Switalski, *Cent. f. Gynäk.*, 19, 1895, p. 889).

When a physician is called upon to decide in a given case which particular cause is in operation, it is useful to bear in mind the age and condition of the patient.

If she is a young girl, the irregularity is most apt to be occasioned by the slow and imperfect development of the uterine blood vessels in the last stage of the body's evolution. Chlorosis is often associated with this as a cause. Young girls are also apt to suffer from an excessive flow following influenza, pneumonia, or enteric fever. A persistent hemorrhage in their case is not infrequently due simply to a glandular polyp, or, more rarely, to a polypoid endometritis. Family tendencies must always be borne in mind.

n unmarried women between thirty and forty years of age irregularity is likely to be caused by a slight displacement (retroflexion) in cases where gins suddenly; when the onset is gradual, it is probably occasioned by a p or a fibroid tumor, or, quite frequently, by tuberculosis of the uterine s; it may also, in cases accompanied by right-sided pain, be caused by an ndicitis.

In married women a threatened or an incomplete abortion must always be med as the efficient cause until its existence is disproved. Only by this ns can mortifying mistakes be avoided. Fibroid tumors also come fretly into play in this class of cases. Almost every woman who presents elf in the late thirties with large fibroids and a history of hemorrhages will give a history of years of treatment for an excessive flow, the cause of which not recognized. When there is any doubt an exploration under anesthesia clear up the diagnosis.

After the age of thirty-five, cancer of the cervix comes into play as an active e of menorrhagia. The frequency with which this disease occurs makes it t important to be always on the watch for it, in order that it may be recogd at the earliest possible moment. Every week of delay in the active treatt (extirpation) of cancer is precious time lost. It is in this class of cases the policy of delay can too often be laid at the door of the general pracner by his fellow specialist as a crime which makes him responsible, year ear, for the loss of many lives.

If a woman over forty is troubled with an increasing instead of a diminng monthly flow, sometimes marked in its earliest stages by a watery disge, and if, on examination, the uterus is found somewhat enlarged, cancer he uterine body becomes probable.

In women who have reached a time of life when cancer may be suspected, rsistent menorrhagia or metrorrhagia sometimes occurs, so severe as to eble the patient and render her profoundly anemic, for which no cure has found short of hysterectomy. The uterus, when removed in such cases, s a rule, found enlarged, and from a microscopic point of view it might onsidered simply as subinvoluted. A microscopic examination, however, als a set of changes, unusual in character, which fully account for the orrhage. The smaller vessels in the mucosa are increased in number, and r walls, in the words of Barbour, "instead of consisting practically of a r of endothelium are thickened by a deposition around this layer of conric lamellae of fibrous tissue with well-stained nuclei." Some vessels are ine, and these run a tortuous course, while other vessels may be normal. ilar vascular changes are present in the muscular walls of the uterus. re are sometimes fibrous changes in the uterine wall and some infiltration und cells. In one of these cases, seen by Bland Sutton (*Brit. Med. Jour.*, , vol. i, p. 840), both ovaries were removed in order to check the hemore, but the patient continued to suffer from it until the uterus was taken out. on remarks in discussing this case and two others of the same nature: "In these three cases the uterus was larger than normal, with thick tough walls; on section the arteries stand out prominently, exposing their thickened coats; microscopically it is seen that the muscle tissue is replaced by an abnormal growth of fibrous tissue." It is noteworthy that this disease is a local affection, which does not even involve the uterine artery and is not associated with a sclerosis of the other vessels of the body.

For a further discussion of this subject see Bland Sutton (*ut supra*), Palmer Findlay (*Amer. Jour. Obst.*, 1901, p. 30), and an excellent paper by H. H. F. Barbour on "Climacteric Hemorrhage due to Sclerosis of the Uterine Vessels," where he reviews some eleven cases already recorded (*Scot. Med. and Surg. Jour.*, June, 1905).

Diagnosis.—The diagnosis of this condition must be made by exclusion, after curettage; and the treatment of it, if it persists, is hysterectomy. Let me, however, here insert a word of caution against considering every woman who suffers from profuse menstruation at the time of the menopause, and who has been shown free from cancer, as a case of capillary sclerosis and therefore a fit subject for immediate hysterectomy. Most cases of "symptomatic hemorrhage" recover with rest and packing and the exercise of patience.

The investigation of any particular case of menorrhagia should be carried on as follows: First, by taking a careful history, noting the age and condition of the patient, with her family history and its tendencies; second, by careful general physical examination, when, if there is anything amiss, as, for example, a bad heart lesion, the diagnosis may be cleared up at once. Let me here utter an earnest protest against the too hasty local examinations in young or unmarried women made by many practitioners and pseudo-specialists. In such cases it is best to assume that the simpler conditions (e. g., vascular disturbances) account for the trouble, and to use appropriate remedial measures of general treatment, and, above all, gain the kindly aid of time in setting things right. If, however, the excessive flow persists, an examination should be made under an anesthetic, when the appropriate treatment can be applied at the same time.

In a married woman, or in one with a long history of excessive menstruation, there should be no delay in making an immediate and thorough local examination. A simple inspection of the introitus, revealing the deep bluish color of pregnancy, may clear up the difficulty. The finger introduced may at once touch a polyp lying in the vagina, or feel its smooth surface just within the cervix. A softened cervix is also an indication of pregnancy, while a nodulated enlarged cervix due to endocervicitis or a friable cancerous cervix are at once evident.

A bimanual examination is next made in order to detect an enlargement of the uterine body, and, if it exists, to determine whether it is equable or more or less globular, in which case it is due to pregnancy, to a subinvoluted or cancerous uterus, or to a polyp within it; fibroid tumors are usually asymmetrical and multiple. Diseased conditions lateral to the uterus, such as the unilateral tumor of extra-uterine pregnancy, a malignant ovarian tumor of greater or less size, or the hardness and tenderness induced by an inflammatory condition of the ovaries, may, if they are marked, at once be detected. If the diagnosis is still not clear, it will be best to make a more thorough investigation of the uterus and its lateral structures by putting the patient completely under the control of the examiner by means of an anesthetic.

When the anesthetic is used for diagnostic purposes it is well to obtain the patient's consent beforehand to the performance of any simple operation which may prove to be required, such, for example, as a curettage, the removal of a polyp, the burning of a diseased cervix, or, perhaps, the rectification of a flexion, or an operation upon the cervix uteri.

Let me here note that the cases which often escape diagnosis are those in which there is a small polyp or a fibroid tumor, perhaps not over half an inch in diameter, in the uterine cavity. In several such cases, occurring in women under forty, where I have excluded every other cause, I have opened the body of the uterus through the vagina by detaching it from the bladder and splitting up the anterior wall; or else through the abdomen, by making an incision in an antero-posterior direction through the fundus into the cavity, as though I were about to cleave the organ into two parts. A little tumor, inaccessible by the ordinary means of exploration, has thus, by this hysterotomy, been discovered and removed with resultant entire relief of the symptoms. An Italian surgeon first practiced this operation. It was first performed in my clinic at the Johns Hopkins Hospital by Dr. W. W. Russell, and I have used it repeatedly with advantage. Several times, on opening the uterus, I have found nothing but a peculiar, long, feathery condition of the endometrium, particularly marked in the cornua of the uterus, and after this has been thoroughly removed by curettage, the hemorrhages have ceased.

TREATMENT OF MENORRHAGIA.

The treatment of a uterine hemorrhage, in order to be efficient, must reach the cause. It is evident, therefore, that a correct diagnosis is essential to a cure. Sometimes it happens that the diagnosis and the treatment proceed *pari passu*, as, for example, in curettage of a diseased endometrium, when a diagnosis is made and a cure effected by means of the same act.

In young women, hemorrhage is best treated at first as a physiological affection of the young tissues, which are taking on a new function. Rest is the prime factor, that is to say, rest in bed for two or three days in each period, beginning in many cases before the flow appears. Dr. Ethel Vaughan finds that many young women are entirely relieved by abstinence from active exertion, such as long walks, the use of the bicycle, or tennis, just before menstruation; if these precautions are observed for from six months to a year, a proper norm is by that time established. It is important to keep the bowels well regulated, and a course of tonic treatment is an excellent adjuvant. I should, for example, give arsenic and quinine in some such form as the following:

℞	Ac. arsenios	gr. $\frac{1}{60}$
	Ex. calumb.	gr. j
	Quin. sulph.	gr. $\frac{1}{2}$

M. ft. pil. I.
Mitte tales, 100. S: 1 three times daily.

Iron is best omitted, and ergot is of no value here; strychnin and hemoglobin are often useful. Stypticin is sometimes serviceable, but adrenalin should be omitted from the therapeutic list. A good way to equalize the circulation by drawing blood from the internal organs is to give the patient a hot bath and put her to bed. If in spite of all precautions and treatments the flow continues excessive and the general health is suffering, examination and curettage may then be proposed. No benefit whatever arises from persistent local treatment in the form of douches and applications; these should, in every case, be avoided as demoralizing and useless. Attention of this kind is well described as "gynecological tinkering."

I would here call attention to the fact that in married women profuse menstruation is often due to some retained product of a conception, passed weeks or months before, of which the patient had no knowledge.

In cases of alarming hemorrhage where it is impossible, either on account of the dangerous condition of the patient or from lack of a correct diagnosis, to take immediate steps toward a radical cure, the following temporizing measures may be employed:

1. A hot douche given at a temperature of 110° to 115° F. for 10 to 15 minutes.
2. Adrenalin, in a dose of 10 minims of a 1–1,000 solution, administered hypodermically.
3. Packing the vagina with the patient in the Sims or in the knee-chest position, so as to secure firm pressure on the cervix. The pack should be made of washed-out iodoform gauze and should not be left *in situ* over twenty-four hours. A fetid pack is a serious complication to any vaginal operation.
4. Elevation of the foot of the bed for 12 to 18 inches.
5. Bandaging the extremities if the patient is in collapse.

A subcutaneous infusion should never be given as a routine practice, as by raising the tension in the blood vessels it increases the hemorrhages. It may be administered, however, in the course of an operation.

CHAPTER IX.

UTERINE DISPLACEMENTS AND THEIR TREATMENT BY MEANS OF PACKS AND PESSARIES.

1. Normal variations in the position of the uterus (p. 177).
2. Causes of fixation and displacement (p. 177): Descensus. Prolapsus. Ascensus. Right and left displacements. Torsion. Anteversion and anteflexion. Retroversion and retroflexion.
3. Pessaries (p. 181): Hard rubber ring pessary. Hodge pessary.
4. Packs (p. 183).
5. Treatment of prolapsus with relaxed outlet (p. 183).

NORMAL VARIATIONS IN THE POSITION OF THE UTERUS.

The uterus is a movable pelvic organ, lying in a position of mobile equilibrium between the bladder and the rectum, and swinging on its broad ligaments between the pelvic walls; below, it is anchored to the vaginal vault, and it is pressed down in gentle anteflexion by the superincumbent small intestines. Thus nicely balanced between these elastic and variable organs the uterus responds instantly to every impulse communicated to it from any direction. A finger introduced into the vagina easily displaces it upward in the direction of the abdominal cavity; the distended intestines, or the hand used in a bimanual examination, push it downward toward the pelvic floor; a full rectum may push it forward into anteposition; while it is at all times susceptible to the varying dimensions of the bladder, upon which it rests as upon a water cushion. Moreover, the uterus is rarely found exactly in the median line; it often inclines a little, and not infrequently quite markedly, to one side or the other. Indeed, the whole organ may be decidedly to one side, and still be perfectly normal in all its functions.

CAUSES OF FIXATION AND DISPLACEMENT.

Any fixation, however, by which the organ is held firmly in one position is pathological and demands attention. Any abnormal condition of this kind is ascertained by making upward pressure upon the cervix uteri with the finger, when, if the organ yields but slightly or not at all (in the absence of advanced pregnancy), some pathological lesion must be sought to explain the abnormality. Let me dwell upon this point for a moment, as I shall not refer to it again. A common cause of fixation is an infiltration of the bases of the broad ligaments from a cancerous cervix; under these circumstances a broad hard mass can be felt extending out laterally from the cervix to one or both pelvic walls, even appreciable sometimes when the cancer is within the body of the uterus, and cannot be seen and felt at the external os uteri. Another common cause of fixation exists in pelvic inflammatory disease involving the uterine tubes and the ovaries, which drop over on to the pelvic floor, and, becoming adherent, excite more or less subperitoneal inflammation. In such cases the fixing masses seem to lie more posteriorly than laterally, and they can best be felt by clearing out the rectum and then introducing a finger up back of the uterus, at which point the bowel seems to pass through a narrow rigid tube. If the patient is then put in the knee-chest position, the uterus, vaginal vault, and broad ligaments, instead of dropping away in the direction of the abdominal cavity, remain rigidly in position as if frozen *in situ*. Fixation may also take place through the growth of an ovarian or fibroid tumor to which the uterus is attached, or by means of which it has become wedged in the pelvis.

Descensus.—Too great freedom of motion is as much an abnormality in the condition of the uterus as any marked limitation of normal physiological movements. When its downward movement becomes so great that the uterus lies upon the pelvic floor instead of retaining its proper condition of equipoise within the pelvic cavity, the displacement known as descensus has taken place, and this is often but a stage in its further descent, which may continue up to the appearance of the cervix at the vaginal outlet (partial prolapse) to the complete extrusion of the organ (complete prolapse). Descensus and prolapse in various forms are usually found in parous women, in whom an injury has occurred to the levator ani muscles coincident with one to the perineal structures resulting in a breaking down of the vaginal outlet.

Ascensus.—This is an upward displacement of the uterus, found in uteri which have become attached to ovarian cysts, and have been drawn upward by the enlargement of the tumors and their extension upward in the direction of the abdominal cavity. When the uterus itself is enlarged, as by a fibroid tumor, the body of the uterus, of course, follows all the movements of the mass as it rises in the abdomen. Such conditions as these require mention only for the sake of completeness, as these displacements never call for treatment *per se*. It is well to remember, however, that when a tumor is removed from a uterus which has been greatly displaced by it, the organ tends to fall to the pelvic floor, having entirely lost its tonicity. It is best, therefore, in such cases, to secure the uterus in a good position as the operation is completed.

Right and Left Displacements.—These may be effected by traction, or by pressure made upon the uterus by a tumor lying laterally to it. A small ovarian tumor in the right pelvis may push the body of the uterus to the left, while a large tumor, which has slipped up into the abdomen, often pulls the body over to that side in the growth originated.

Torsion.—Torsion of the uterus is often seen in connection with fibroid tumors, and sometimes, though rarely, in ovarian tumors associated with a twisted pedicle. (See one of 180 degrees, reported by Küstner, Veit's *Handb.*

. *Gynäk.*, 1897, vol. i, p. 109.) In a case of torsion observed by Cameron, r., of Glasgow, the circulation was interfered with to such an extent that an xtensive hemorrhagic infarct was produced about a large fibroid tumor of the uterus.

Right and left displacements, as well as torsions, call for only passing notice, as they are diagnosed and treated incidentally to the conditions with which they are found associated.

Anteversion and Anteflexion.—Anteversion and anteflexion are the normal ositions of the uterus when the bladder is empty or but moderately full, and t is incomprehensible to us to-day that our predecessors could write so dif-usely and treat so actively a purely physiological condition. Among the by-one gynecological armamentarium are numerous curiosities in the shape of nteflexion and anteversion pessaries. An anteflexion becomes pathological hen the uterine fundus is flexed upon the cervical portion of the organ so harply that the body and cervix seem almost parallel. In such a case as this, owever, the defective form of the uterus is due to a developmental fault, and e patient is not to be helped by pessaries designed to push up the fundus or y operations on the cervix intended to straighten the canal.

Retroversion and Retroflexion.—These are terms designating a permanent ackward displacement of the uterus, by which the fundus comes to lie in the acral hollow or down between the utero-sacral ligaments, while the cervix ccupies a position in front of the body. This condition is so frequently ound, and the opinions and practice of eminent specialists are still so at vari-nce in regard to its proper treatment, that it is important to treat the sub-ect somewhat at length and to speak with such decision as experience may ustify.

The diagnosis of anteversion and anteflexion is made by noting, first he position of the cervix, which generally lies in the axis of the vagina, and hen the position of the fundus. A finger pushing the anterior vaginal wall ightly upward notes the absence of the resistance offered by the uterine body n its normal site. A bimanual examination, made with one finger resting ehind the cervix and raising it a little so as to afford a plane of resistance gainst which to palpate with the hand on the abdomen, shows that the uterine ody is not simply erect in the pelvis. Then pressing a little more posteriorly vith the vaginal finger, and gliding down over the recurved anterior face of he uterus with the abdominal hand, the fundus is discovered lying behind n retroposition. The failure of a little effort to throw it forward shows that he displacement is permanent. The existence of an organic connection between he cervix and the mass posterior to it is clearly demonstrated by grasping the ervix with a vulsella and making gentle, steady traction on it, keeping, at he same time, a finger on the fundus through the rectum or examining the rgan bimanually as it is pulled down by an aid.

If the patient is stout it is well to propose a more complete examination under an anesthetic. A transitory oblivion, secured by nitrous oxide gas or chloride of ethyl, will usually suffice to demonstrate the presence of a tumor lurking behind the cervix, which seemed at the more superficial examination to be the fundus uteri. And yet let me here utter a word of caution, for if a mistake is made at all it is most likely to occur at this point, especially when a myoma the size of an egg is attached to the posterior surface of the uterus, which is pulled over by it backward. The unusual size and antero-posterior thickness will be of assistance here in clearing up the diagnosis, especially if a sound is introduced into the uterine cavity when the finger in the rectum detects the increased thickness of the intervening body. The uterine sound used so much by Sir James Y. Simpson and his contemporaries as a means of determining flexions and correcting them, has now passed largely out of vogue. There can, however, be no objection to its occasional gentle use for the purpose of diagnosis and demonstration, but it should never be employed to prize the uterus up into an anteposition.

A sharp line of distinction must be drawn between retrodisplacements in women who have not borne children and those following childbirth. We will first consider those affecting women who have never borne children.

Many patients in this group make no complaints whatever directly referable to the uterus, and these cases may be dismissed as symptomless displacements. In these cases the retroposition is often congenital, as shown by the short vagina which keeps the cervix so low in the pelvis that the fundus must of necessity fall back; here the retroposition is natural and an anteposition would be abnormal, so that all efforts to induce such a uterus to remain in anteversion will, fortunately for the patient, prove futile. If the patient complains of backache, bearing down pains in the pelvis, and dysmenorrhea, the practitioner must be on his guard against tracing a causal relationship between the displacement and the symptoms, remembering that women with

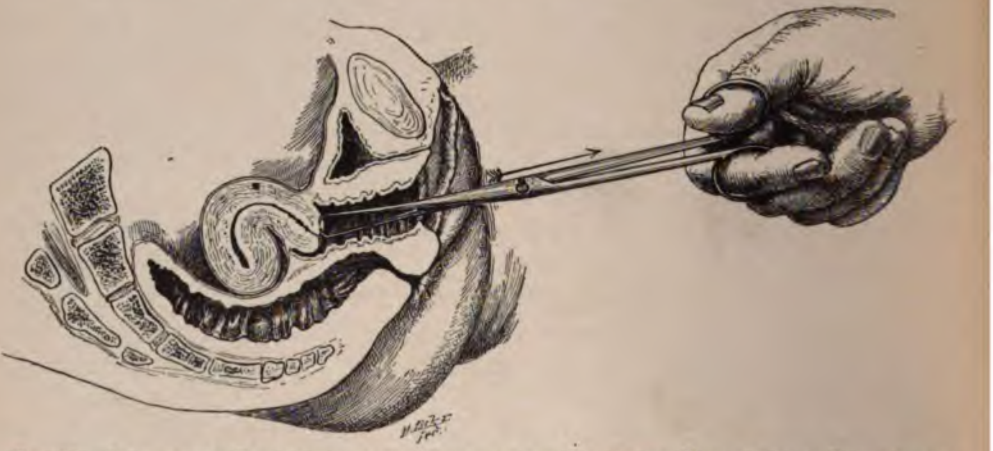


FIG. 92.—STEPS IN THE REDUCTION OF THE UTERUS IN THE PALLIATIVE TREATMENT OF RETROFLEXION.

The anterior lip of the cervix is grasped with a tenaculum forceps and drawn in the direction of the arrow. (See p. 180.)

normally placed uteri make the same complaints. Even if he secures a decided measure of temporary relief from the use of a pessary or a pack, he must not conclude that the displacement is certainly the cause of the symptoms, because when the retroposition is permanently relieved by an operation, all the old symptoms may return. It is wise never to make an absolute promise of relief from the correction of an orthopedic deformity. I must admit, however, that I do constantly find cases which are greatly relieved, or even cured by appropriate remedial measures (see Chapter XXIX, Vol. II).

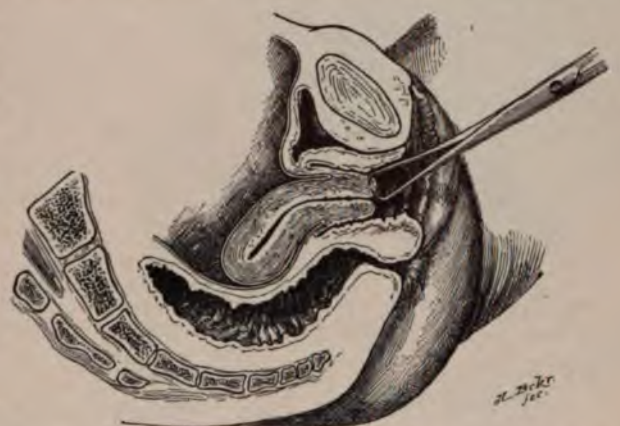


FIG. 93.—The traction straightens out the angle of flexion and brings the body of the uterus within easy reach. (See p. 180.)

All cases of acute retroflexion induced by violent exertion, a fall, lifting heavy weights, or going too long with a full bladder, which are characterized at the outset by symptoms never before experienced, demand prompt relief. The treatment should be begun by emptying the bladder and the bowel, after which, under a light anesthetic, the cervix is fixed with a vulsella and the fundus pushed upward and forward, the cervix, at the same time, being pushed back with the forceps toward the sacral hollow. A pack is then applied in front of the cervix, and the patient kept in bed for two or three days, with a warning to empty the bladder at regular intervals of a few hours.

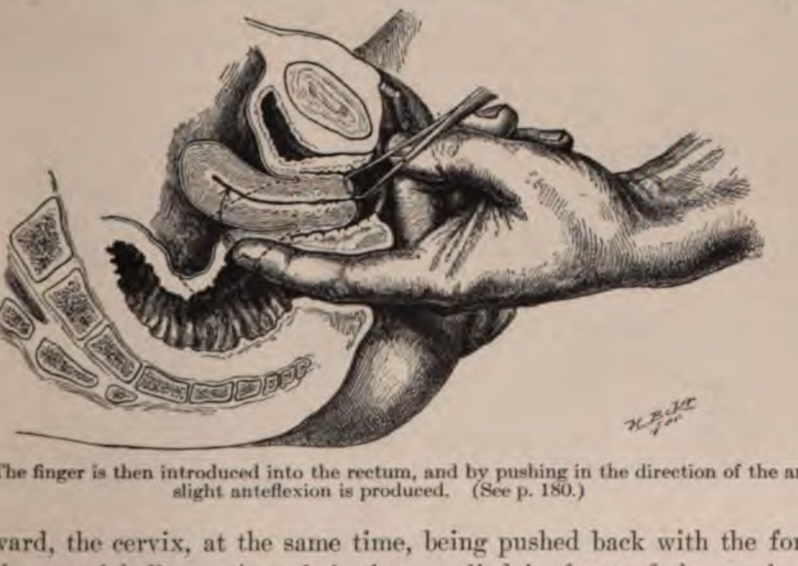


FIG. 94.—The finger is then introduced into the rectum, and by pushing in the direction of the arrow a slight anteflexion is produced. (See p. 180.)

The palliative measures which may be used to relieve a retroflexion are: reposition, the pessary, and the pack.

Reposition.—Reposition is effected by one of several manual devices. The simplest of all is to push up the fundus of the uterus with a finger introduced into the vagina, and then catch it with the fingers of the other hand acting through the abdominal wall. This can only be done when the abdominal walls are thin and the uterus not too far back. In every act of reposition the cervix should be pushed well back and high up in the pelvis. If there is a retroflexion, the uterus can not be redressed in this simple manner, and in such cases the best plan is to catch the cervix with a tenaculum forceps and draw it down the vagina, so as to straighten out the flexion (see Figs. 92 and 93); the body is next pushed up from between the utero-sacral ligaments by means of a finger in the rectum (see Figs. 94 and 95), after which the fundus is caught and drawn forward, while the cervix is, at the same time, pushed back into the position previously occupied by the fundus (see Figs. 96 and

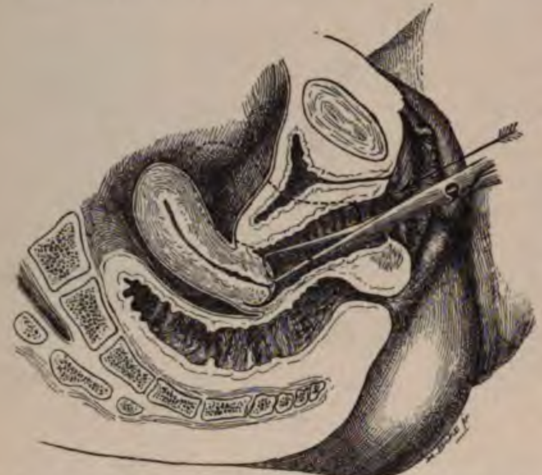


FIG 95.—The forceps are then used to carry the cervix well back into the pelvis.

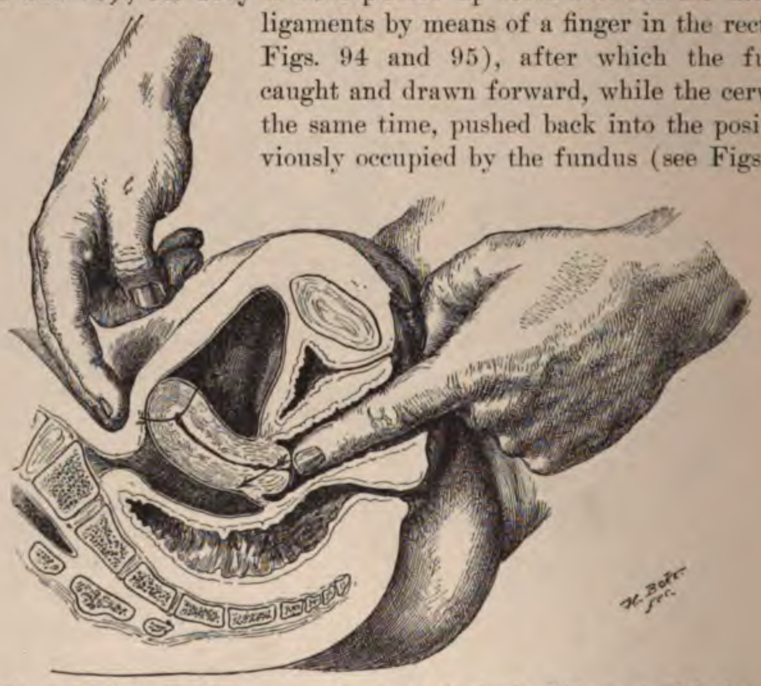


FIG. 96.—The flexion being in this manner reduced, the fundus is within reach of the hand palpating through the abdominal wall, grasping it and forcing it in the direction of the arrow; a finger in the vagina at the same time pushes the cervix back into the sacral hollow.

97). The action of gravity may sometimes be utilized in these manipulations to bring the fundus into position by putting the patient into the knee-chest position until the body of the uterus has escaped from the sacral hollow. Afterwards the patient must be turned cautiously on her back, and the fundus brought well forward behind the symphysis.

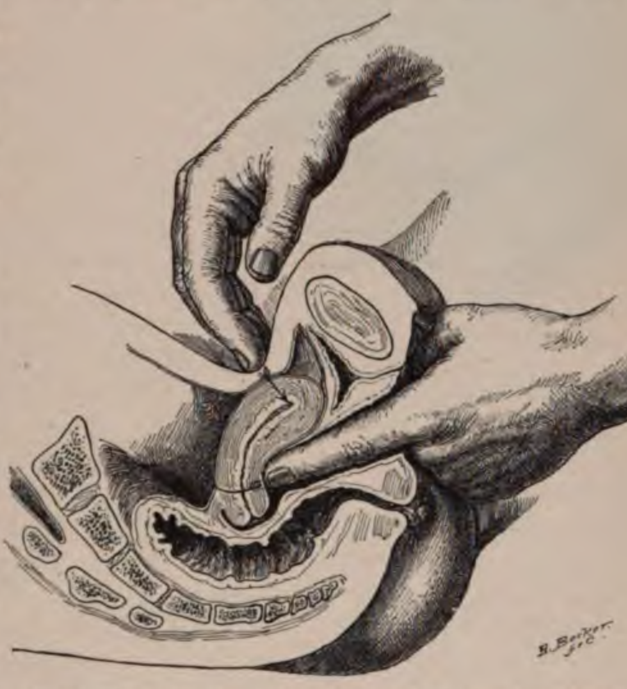


FIG. 97.—The final step is the production of an extreme anteposition of the fundus, and the insertion of a pack into the upper part of the vagina to hold the cervix up.

The following points must be carefully noted in connection with the manual treatment of retroflexion:

First: All efforts at reposition must be abandoned if more than moderately painful. Much more harm than good is done by dragging a uterus into anteposition at the cost of much suffering.

Second: Never use any kind of intra-uterine instrument, such as may be found in the gynecological junk shops of a past generation, to prize the uterus up into position. They are frightfully dangerous.

Third: Retroposition, however ideal, rarely succeeds in retaining the uterus in an anterior position for more than a short time, perhaps a few hours. The exceptions to this rule are the recent acute retroflexions.

Fourth: The reposition must be followed by a pack or a pessary in order to make it effective.

PESSARIES.

The best pessary is made of hard rubber. Soft rubber rings should be avoided, for they soon become foul and excite a troublesome leucorrhea. Of the hard rubber pessaries suitable for multiparous cases there are two kinds, which, I think, fulfill all indications. These are: the hard rubber ring pessary, and the Hodge pessary (see Fig. 98), which has a broad square bar in front and a strongly reinforced posterior bar behind. This, if traced to its genesis, should properly be called the Hodge-Thomas-Mundé pessary.

The pessary's mode of action is not so mysterious and difficult to analyze as our predecessors, accustomed as they were to elaborate treatises on the mechanism of labor, were wont to imagine. A properly fitted pessary simply splints the loose vaginal walls and keeps the cervix well back in the pelvis. If the cervix is held far enough back, the fundus can not get behind it, and practitioners, acting on this fact, are apt to err by inserting a large, long pessary, which makes strong posterior pressure. Such an instrument is often painful in introduction and uncomfortable while worn; moreover, it may ulcerate the posterior vaginal wall even to the extent of cutting through it, and, if tolerated, it eventually stretches the vagina.

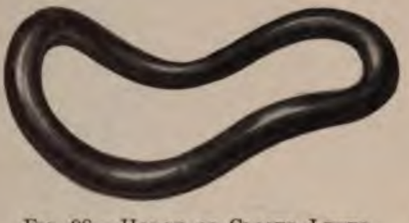


FIG. 98.—HODGE OR CLOSED LEVER PESSARY.

The posterior bar to the left lies behind the cervix while the anterior bar lies in contact with the anterior vaginal wall behind the symphysis.

The rules for the choice and the application of a pessary are: (1) It must be a snug, easy fit in the vagina, not loose enough to wobble about and not tight enough to make pressure at any point; (2) it must stay in place, and there must be no tendency to present at the vaginal orifice, far less to slip out. Each pessary must be adjusted to the particular case for which it is used, just as a shoe is fitted to the foot, and to do this satisfactorily it is necessary to keep an assortment of different sizes on hand. I find that, as a rule, there is a tendency to use pessaries that are too long and too large. If it can not be inserted without pain, it is best to use a pack for a short time. The discomforts caused by the introduction of a pessary may be lessened by placing a pledget of cotton saturated with a 10 per cent solution of cocain just within the vaginal opening for about eight minutes beforehand. The introduction is accomplished by drawing back the posterior vaginal wall and then slipping in the pessary, coated with vaseline, with its long axis corresponding to the antero-posterior direction of the retracted vulvar orifice. Care must be taken to avoid rubbing the urethral orifice and the delicate anterior vulvar tissues. As soon as the pessary is within the vagina it is turned and pushed back with the finger until the cervix is felt to lie within the ring or in front of the posterior bar (see Fig. 99).

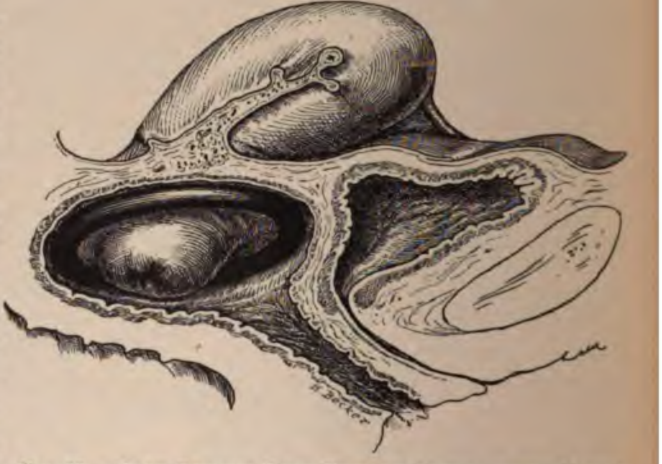


FIG. 99.—HARD RUBBER RING PESSARY LYING AT THE VAGINAL VAULT ENCIRCLING THE CERVIX, AND SERVING TO LIMIT THE TENDENCY TO DESCENSUS.

Every woman who wears a pessary should use a douche at intervals of two or three days, and it is often most conducive to cleanliness to remove it for three or four days each month during the menstrual period. A pessary should never be looked upon as a permanent fixture. Sooner or later it ought to be removed, when it may be found that the patient does as well without it. If an operation is done to correct the displacement, the patient must be told that there is no further occasion for it, and she must dispense with it. Some women get coddled into the pessary habit, when their narrow lives circle around the state of their pelvic organs and the mysterious action of the pessary, until their condition becomes a sad one, for which, I am sorry to say, some physician is usually responsible. I am very apt to break up such a state of things by urging an operation, after which I will not allow a pessary to be spoken of.

PACKS.

A pack of wool, of cotton, or of gauze, forming an elastic and sometimes a medicated support for the cervix and vaginal walls, is useful occasionally in place of a pessary. If the patient is to return within twenty-four to forty-eight hours for its removal, a number of wads of wool may be inserted in front of the cervix so as to form an elastic column loosely filling the vagina. They are best inserted with the patient in the Sims position and the vagina ballooned out. It is a mistake to stuff the vagina tight with the pack. A saucer-shaped piece of absorbent cotton filled with boroglycerid or ichthyol and glycerin (10 per cent) may be put under the cervix as the first installment, followed by a succession of one or more wads. If the vagina is filled with absorbent cotton it soon becomes soggy and makes a solid plug. Some patients learn to insert the pack themselves, but any such intimate meddling of the patient with her own person should never be encouraged, unless absolutely necessary, for it is not only nasty, but tends to a bondage not easily broken. If the patient is to remove the pack herself, a piece of thread should be attached to each wad and left hanging outside.

A pack is, at best, but a temporary expedient, useful in testing the relief to be derived later from an operation correcting the retroflexion, or by giving relief in some pelvic inflammatory affection and possibly reducing the inflammation by the hygroscopic action of the glycerin, which tends to keep up a watery action from the vagina. Some patients while wearing a pack are obliged to use a vulvar pad. A long strip of gauze may be used instead of cotton or wool. When gonorrheal vaginitis or cervicitis is present, a strip of gauze saturated with a 20 per cent solution of argyrol may be used with great effectiveness; it should be renewed every day.

TREATMENT OF PROLAPSUS WITH RELAXED OUTLET.

Retrodisplacements in women who have borne children are often associated with descensus and also with relaxation of the vaginal outlet, commonly called torn perineum; in studying such cases particular attention should be given to these attendant conditions. Very often these cases do not suffer at all from the flexion, but a great deal from the dragging of the uterus toward the vaginal orifice when the patient is on her feet. This disability can not be estimated when she is lying on her back, but if she stands with one foot on a low stool and makes a bearing down effort, the uterus can be felt to advance toward the vaginal outlet in a marked degree. It is these successive movements of descent toward a broken down pelvic outlet that has lost its elastic resiliency, which throw the uterus back again and end in a prolapsus. When the patient is on her back, however, the physician, watching the vaginal outlet, will see a separation of the anterior and posterior walls and a rolling down and out of the tissues, more or less marked according to the extent of the injury. If there is much vaginal eversion, any pessary the patient can tolerate will inevitably roll out when she is on her feet, sometimes under most embarrassing circumstances. A small pack up near the cervix will stay in place better than a large one, but very little relief can be given beyond what is secured by rest in bed and some preparatory glycerin packs before performing an operation for pulling the uterus in place (see Chap. XXIX, Vol. II) and restoring the broken outlet (Chap. XV, Vol. I). In cases where the vaginal outlet is not extremely large, a ring pessary of large size or a Mundé pessary (see Fig. 100) may give much relief.

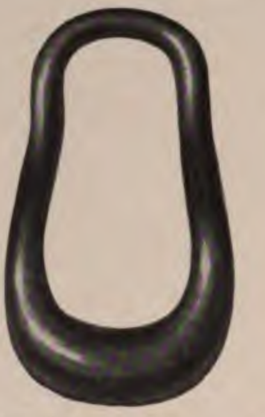


FIG. 100.—MUNDÉ PESSARY OR MORE PROPERLY HODGE-THOMAS-MUNDÉ PESSARY.

The peculiarity of this pessary is the reinforced posterior bar.

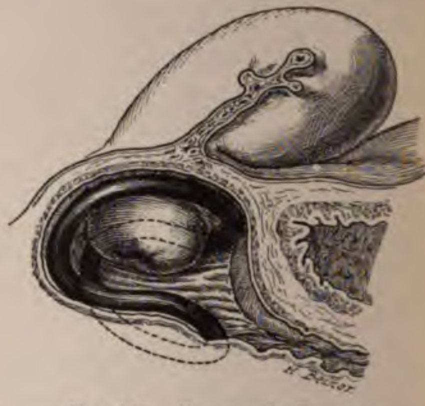


FIG. 101.—GEHRUNG'S PESSARY.

Especially useful in descensus of the anterior wall. The pessary ought to lie in closer relation to the symphysis pubis.

There is one troublesome class of cases in which the vaginal wall rolls downward and outward, until it fits the vulvar orifice like an egg; these are best relieved by a peculiar pessary devised by Gehrung, of St. Louis. It can be made by doubling one of the rectangular Hodge pessaries on itself, until the anterior and posterior bars lie parallel about an inch apart, one a little in advance of the other. In other words, the pessary is bent a little in advance of the center, and when thus bent it has the shape of two letters U joined at the ends. It must be inserted in such a manner that the cervix lies in the open sinus between the rounded ends of the letters (see Fig. 101). The advantage of this pessary is that it keeps constantly tilting, and does not present at the vaginal outlet, so that it can not escape.

Prolapse of the uterus can sometimes be relieved by a suitable pessary, and under certain conditions, such as extremely feeble health, or very old age, as well as when the patient is unusually fat, this is a great boon. Packs are of value in prolapse by bringing down hypertrophied tissue or healing ulcerated areas, as long as the patient is willing to remain in bed. It is remarkable how soon the parts tend to resume their normal appearance with rest, reposition, packing, and douching.

Quite early in my practice I gave a patient who was a great sufferer from prolapse a metal ring pessary supported on a stem which entered the vagina attached on the outside to a metal rod, curving between the thighs and abdomen in front and the back behind, where it was held in place by a girdle. She was so entirely relieved that she refused to consider any other form of treatment. I would not, of course, grudge any sufferer whatever relief she might obtain in any way, but when I mention this single instance I condemn the general use of this type of pessary; they are costly, and when they are obtained, at considerable expense, they usually give a great deal of pain, and have to be discarded; moreover, they are clumsily unsurgical.

In choosing a pessary to hold back a prolapsus, much depends upon the condition of the vaginal outlet. If this remains fairly tight, or if it has been restored by an operation, it is much easier to keep the uterus and vagina within the pelvis by means of a pessary than when the vaginal orifice is large and everted.

When the vaginal outlet is fairly good, the anterior wall rolls down first, and just here the Gehrung pessary does excellent service by tumbling over in the vagina and preventing further eversion. With a little larger orifice, and also with the smaller orifices, a rubber ring often proves most serviceable. It is a pity to use a pessary made of soft rubber, but it can not be helped in this class of cases, as here we want to introduce one so large that it will fill out the slack vagina and, at the same time, be several sizes too large to escape from the vaginal orifice. The desired end is best effected by a pessary which can be elongated by squeezing during its introduction. A woman with such a pessary must use a douche daily, and she ought to report, in order to have it changed, at least every three months. It is sometimes possible, however, by using a little force and causing some pain, to introduce a hard rubber ring pessary which lies in the vagina loosely enough to cause relief; if this can be done it is always preferable. All prolapsus pessaries have a broad disk with a small hole in the center to keep the lax tissues from slipping through the opening and becoming strangulated. In all manipulations abundance of vaseline should be used.

If the student will insert a medium sized disk pessary in a prolapsus case, and then tell the patient to bear down, while at the same time he watches the vulvar orifice, he will note, first a gaping at the orifice, then he will observe that the pessary drops from its position behind the symphysis or above in the vagina and presents by one margin at the orifice, then it begins to widen the orifice like a wedge, and finally, with further expulsive efforts, it rolls down and out. It will then be evident to him that if the edge of the pessary could only be kept from dropping down toward the orifice it would be retained and the prolapse prevented. A group of hard rubber pessaries, known as stem pessaries, and used chiefly in Cermany, have been devised to prevent this rotation. A short stem is attached to a large disk, and when the disk lies up under the cervix the stem lies in the axis of the vagina, just reaching to, or perhaps even protruding from, the orifice. As soon as the edge of the disk tends to drop down and present itself at the vaginal outlet, the stem resting there meets the perineum, and further rotation is prevented.

Mengé's pessary is one of these disks, having a detachable stem. After the disk is introduced the stem is pushed into the center, and with a little turn is fastened by a bayonet lock.

It sometimes requires considerable experiment and patience to find the right pessary for any given case, but it is well worth the effort, for the relief afforded is often so great that the need for a troublesome and frequently unsuccessful operation is obviated.

CHAPTER X.

ANESTHESIA.

1. Choice of an anesthetic (p. 187).
2. Local anesthesia (p. 187): Cold. Cocain.
3. General anesthesia (p. 189): The anesthetizer. The anesthetic. Precautions. Signs of complete anesthesia. Blood pressure.
4. Nitrous oxide gas (p. 194).
5. Ether (p. 196).
6. Chloroform (p. 198).
7. Nitrous oxide-ether sequence (p. 201).

The choice of an anesthetic and of a method of administration are matters of the utmost importance, for the improper use of anesthesia may convert one of the greatest blessings in surgery into an agent of death.

Three forms of anesthesia are employed in gynecology: local, general, and spinal.

In local anesthesia only a small area of the body is anesthetized.

In general anesthesia the anesthetic is inhaled and a state of unconsciousness induced during which the most extensive and prolonged operations can be done without causing pain.

In spinal anesthesia a solution of cocain or of cocain and adrenalin is injected by puncture into the subarachnoid space, and in a short time it induces anesthesia of that portion of the body which lies below the point of injection. This method, although it has been given extensive trial since its introduction by Bier a few years ago, has, so far, proved unsatisfactory and unsafe for general use, and will not be further considered here.

LOCAL ANESTHESIA.

Local anesthesia is best adapted to those cases in which the seat of operation covers but a small area and the operation itself is of a minor character and of short duration. It is induced in three ways: by applying cold or a solution of cocain to the surface; by injecting normal salt solution into the deeper layers of the skin; or by constriction.

Cold.—Cold anesthetizes the surface by reducing the temperature nearly to the freezing point and thus paralyzing the nerves of sensation. The application of cold for anesthetic purposes about the pelvis is restricted to a narrow field. It may, for instance, be employed in "freezing" the skin over a labial abscess or on the lower part of the abdomen, when a small incision is made for the insertion of a trocar in cases of ascites or ovarian cyst.

Anesthesia by cold may be produced either by the application of ice, or by directing a fine ether spray against the area of operation for about five minutes. If ice is used it should be sprinkled with salt, wrapped in a thin cloth, and the salted side applied to the spot for about five minutes, when the blanched surface will show the effect of the agent. The refrigeration of the surface by ethyl chloride is perhaps the best method for applying cold over a small area, and the best preparation of it is the ethyl chloride (Bengué) supplied to the trade in glass vials with brass tops perforated by a capillary opening and closed by a screw cap. Each tube contains 30 gm. of ether, and is sufficient for from ten to fifteen minor operations.

The efficiency of the ethyl chloride depends upon its low boiling point, which is 12.5° C. The anesthesia induced by it will be found valuable in such minor operations as evacuating abscesses about the vulva, opening stitch-hole abscesses, incising a suppurating pile, etc. The anesthetic effect is obtained by holding the nozzle of the instrument from six to eight inches away from the skin while the fine spray plays upon it. The color of the surface at once changes, and in less than half a minute it presents a white, parchment-like appearance; the anesthesia thus induced lasts about two minutes. The action is more rapid in summer.

Cocain.—Cocain hydrochlorate may be used for short operations on the skin or the mucous membrane, either by local application, or by injection under the surface of the skin. Operations to which cocain is best adapted are the removal of pedunculate tumors, the incision of a suppurating gland or vaginal cyst, the preparation of the surface of the rectal mucosa for the injection of hemorrhoids with carbolic acid, or in allaying the sensitiveness of the urethra before introducing a speculum. It takes about five minutes to produce anesthesia by this means. Solutions of cocain should never be injected into the urethra or rectum, as the drug is quickly absorbed, and, in a certain percentage of cases, its use has been followed by collapse.

Laparotomies and extensive dissections may be done under local anesthesia by the method of Schleich, where dilute (.1 per cent or less) solutions of cocain are injected into the skin and other tissues before incision. This method is especially valuable where some contra-indication to a general anesthetic exists. In such cases, after a preliminary dose of $\frac{1}{8}$ to $\frac{1}{4}$ gr. of morphin, the operation is begun under local anesthesia by the injection of dilute cocain or eucain solutions, and if the injections are skillfully done, the peritoneum may be reached and divided with little or no discomfort to the patient. It is a valuable aid to have an assistant stand at the patient's head and distract her attention by more or less continued conversation. During the separation of the abdominal walls by retractors, or the handling of the viscera, it may be necessary to induce semi-consciousness by a few whiffs of a general anesthetic administered from time to time. For the skin incision the solution should be injected by successive punctures of the needle, which is held almost parallel to the surface, so that the solution goes into, and not nder, the skin and raises a wheal. The second puncture is made just within e periphery of the first wheal, and the process is continued throughout the ngth of the desired incision. After the skin has been divided, the undering structures are treated in the same manner as they are met with, especial re being taken not to divide any nerve which becomes exposed until it is oroughly infiltrated.

In 1888 I did a celiotomy under local anesthesia produced by injecting or 12 minims of a 2 per cent solution of this cocain at several points in e line of incision. The patient experienced no pain until the peritoneal vity was opened and the pelvic organs handled. The incision was sewed up hile the tissues were yet under the effects of the cocain, and the patient was ut to bed, having been conscious of every step of the operation, and experincing only slight pain.

When local anesthesia is used for operations in the vagina a pledget of bsorbent cotton is saturated with a 5 to 10 per cent solution of cocain and pplied to the part for five minutes. The application may be repeated from ime to time during the operation, although the effectiveness of subsequent pplications is seriously interfered with by the flow of blood, which washes way the solution as soon as it comes in contact with the tissues.

Local anesthesia is sometimes used for operations upon the perineum. In is case a few minims of a 2 per cent solution, or larger amounts of a weaker lution, should be injected as described above by multiple punctures quite perficially along the line of incision or denudation. Such an operation can nly be done on a patient who has excellent control of her nerves. It is well to gin the operation about three minutes after the injection, before the fluid is bsorbed; the denudation in the anesthetized tissues then permits the injected uid to escape over the wound and keeps up an anesthetic effect. Such an operaon must be performed rapidly, all materials must be at hand, and assistance ust be prompt. The concluding steps are sometimes painful, and are satisctorily completed only by exercising a great deal of moral suasion over the atient.

The disadvantage of local anesthesia is that it can not be depended upon n long operations, and as the length of every operation is uncertain, there is o security that it may not give out.

GENERAL ANESTHESIA.

General anesthesia suspends consciousness, relaxes the whole body, and puts e patient, for the time being, completely at the disposal of the operator. t is therefore suitable for prolonged, difficult, and painful operations.

The Anesthetizer.—The office of the anesthetizer is scarcely second in imortance to that of the operator; it is a serious error to think that this responible position may be delegated to an inexperienced person, for timidity, bad dgment, or lack of experience may result in an imperfect anesthesia which arasses and interrupts the operator; the consequences to the patient may be even more serious, for unskillful handling of the anesthetic may kill the patient on the table, or induce a bronchitis or pneumonia with fatal results. An unskilled anesthetizer is also apt to forget his office and become absorbed in the operation, with imminent risk to his charge. As the surgeon's attention must be engrossed by the operation, it is highly essential that the assistant who gives the anesthetic should be thoroughly reliable, because to him must be intrusted the administration of stimulants if danger symptoms arise. If the operator has to direct the anesthetizer, it is confusing to both, and the anesthetic is likely to be improperly administered. If it is necessary to call upon an inexperienced person to administer the anesthetic, he should be fully instructed beforehand, and the operator should be constantly on the watch.

Chloroform especially should never be intrusted to an unskilled anesthetist, as the danger from too concentrated a dilution is greater and the onset of serious symptoms more sudden and obscure than is the case with ether.

Choice of an Anesthetic.—Ether, chloroform, and nitrous oxide gas, alone or in some combination or sequence, are the only anesthetics universally used. Nitrous oxide anesthesia can not easily be prolonged more than five minutes, so that the choice of an anesthetic for lengthy operations lies between ether and chloroform. This choice has given rise to heated controversy since the almost simultaneous discovery of the two anesthetics sixty years ago, and the last word has not yet been said. The use of each has had in the past its geographical boundaries, ether being the anesthetic *par excellence* of the northern part of the United States, while chloroform has been used almost universally in the Southern States, in England, and on the Continent of Europe. Ether, however, has been making its way more and more, first into the German clinics, then into France and England, and most recently into the southern parts of the United States. This result has been gradually accomplished by the indisputable evidence of collected reports of many thousands of cases of anesthesia by both drugs, showing that chloroform is from three to six times as dangerous as ether. Julliard gives the mortality from ether, based on 314,738 administrations, as 1 in 13,000 or 14,000. Mikulicz, in a total number of 240,806 chloroform anesthesias, gives the mortality as 1 in 2,075.

It has been claimed that there is a greater tendency to pneumonia after the administration of ether, but this idea seems to be without foundation, as the pneumonic process is no longer believed to be the result of direct irritation of the air passages, but is probably of embolic origin. It occurs with as great frequency after local cocain anesthesia as after either ether or chloroform. Chloroform is more likely to produce nephritis, and degenerative changes, particularly of a fatty character, in the heart muscle. It seems safe to prophesy that, unless some new anesthetic superior to either ether or chloroform appears, ether, administered in definitely regulated dilution, will be the anesthetic of the future.

Precautions during Anesthesia.—Before giving any anesthetic the character of the respiration must be noted, and the heart must be carefully examined.

The nature and action of the anesthetic should be explained to the patient. The face should be lightly anointed with vaseline, and the eyes and mouth covered with soft towels. I have seen the whole side of the face badly burned by chloroform, due to the neglect of this precaution. The room must be perfectly quiet, and no talking should be permitted, as it excites the patient and retards the progress of the anesthesia.

It is best for the anesthetizer to accustom himself to taking the pulse in the temporal or facial as well as the radial artery. It is not always convenient to take the radial pulse.

The following rules regarding the preparation for anesthesia apply to the administration of both ether and chloroform:

1. The diet should be carefully regulated for, if possible, several days before administering an anesthetic, only easily digested foods being given. On the day preceding the operation, liquid or soft diet should be insisted upon. During this period the bowels must be freely moved each day, either by a mild laxative or an enema. Nausea and vomiting will be much less if the patient fast at least six hours before taking the anesthetic.

2. In nervous patients, a small dose of morphin, given about half an hour before anesthetizing, renders them more tractable. Atropin, in doses of $\frac{1}{150}$ to $\frac{1}{100}$ of a grain, is said to lessen the bronchial secretion and to act as a mild respiratory stimulant, but in my experience it has not proved of great value.

3. False teeth and all foreign bodies should be removed from the mouth.

4. Bands which tend to constrict the neck or waist must be loosened.

The anesthetist should remember the general rule that the patient does best with the least possible amount of anesthetic. The necessary quantity varies with the individual susceptibility of the patient and the character of the operation. Abdominal, rectal, and vaginal operations require, in general, complete relaxation. During the first two stages of ether anesthesia, after incomplete unconsciousness has supervened, the third stage will be reached most quickly if the ether is as concentrated as possible and as little air admitted as may be. With chloroform, caution must be observed throughout; the solution must be weak and plenty of air admitted. During the early stages of anesthesia, the cautious anesthetizer will assure himself that he has control over the jaw, particularly in very muscular patients, as a muscle spasm may clamp it, and if the tongue obstructs the air passages at the same time, dangerous asphyxia may ensue. I have never had occasion to pass a ligature through the tongue to pull it forward. This can only be necessary in operations on the face or throat, where it is impossible to pull the jaw forward and throw the head back, for this procedure skillfully carried out will open the upper air passages. In hundreds of cases I have never been compelled to use swabs to clear the throat and mouth of mucus. If the position of the head and jaw is correct, the collection of mucus will work itself into the mouth, where it may be gently removed by a soft towel or a piece of gauze. When the third stage is reached, the anesthetist must always consider the problem of giving a sufficient amount of the anesthetic to keep the patient well relaxed, and yet not enough to overstep the bounds of prudence.

In prolonged operations, or operations upon debilitated patients, the patient must be kept thoroughly warm in order to counteract the depressing drop of temperature due to the anesthesia; this is best accomplished by hot-water bags placed near different parts of the body.

Signs of Complete Relaxation.—1. Loss of conjunctival reflex. (The common practice of testing the eye reflex by touching the conjunctiva with the finger tip is to be severely condemned, for not a few patients have developed a severe conjunctivitis from such treatment).

2. Fixed, contracted pupils.

3. Slow, regular, and deep inspiration.

4. Complete loss of general reflexes and resistance.

Great difficulty is always experienced in anesthetizing patients addicted to the use of morphin or alcohol; indeed, it is sometimes almost impossible to obtain complete relaxation in such cases; the breathing throughout is stertorous, and interferes seriously with the proper exposure in abdominal operations by constantly forcing the intestines into the field of operation. Stertorous breathing, if prolonged, is an indication of asphyxia, but it is usually quickly relieved by allowing the patient more air, by throwing the head backward and the jaw forward, or by clearing the mouth of mucus.

The difference in the color of the face induced by simple mechanical asphyxia and by that produced physiologically from the drug is worthy of attention; in the former the face becomes blue, the eyes protrude, and the features swell, while in the latter the change is more gradual, the face does not swell, although it becomes livid, and changes slowly into a grayish pallor. This pallor is often the first signal of danger, as the respirations may become imperceptibly shallower and shallower without mechanical signs of interference, and the anesthetizer may be unaware of the change.

When the character of the respirations does not become altered in response to the stimulation caused by an increase in the concentration of the ether, it suggests that the narcosis may have been pushed too far.

The danger symptoms are:

1. Shallow, rapid respiration or cessation of respiration.
2. Weakening or stoppage of the pulse.
3. Sudden pallor.
4. Dilated, fixed pupils.
5. Dark-hued blood replacing bright arterial blood.
6. Sudden cessation of bleeding in the course of operation. The anesthetizer will naturally notice the first four points, the operator the other two, and, sometimes, the first.

Blood Pressure during Anesthesia.—In all cases of anesthesia it is of the utmost importance that the anesthetist should keep in close touch with any change in the cardio-vascular condition of the patient, as it is through this system, directly or indirectly, in the large majority of cases, that immediate danger intervenes. A change in pulse rate is the chief, and, usually, the only guide that the anesthetist has to these changes in general condition. The ability to detect changes in pulse strength by palpating the temporal, facial, or even the radial artery, is so vague that even to the most skilled only the broadest distinctions are possible. Pulse rate may be an inverse measure of pulse strength, but this is a rough and uncertain guide and misleads in many instances. A small rapid pulse almost invariably gives the impression of weakness, whereas it may be much above normal strength, and a slow pulse with a large wave often feels much stronger than it is in reality. Practical instruments for clinical use which measure blood pressure accurately add a most valuable element in recognizing and correcting dangerous changes in the patient's general condition during operative procedures. In those cases where the preliminary examination has demonstrated a weak, hypertrophied, or diseased heart or other cardio-vascular abnormality; or where the intended operation is of such serious nature as to make excessive hemorrhage, shock, or undue heart strain probable, a careful record of the patient's blood pressure before, during, and after operation will afford a most valuable control upon the general condition, and often be the means of an early recognition of danger.

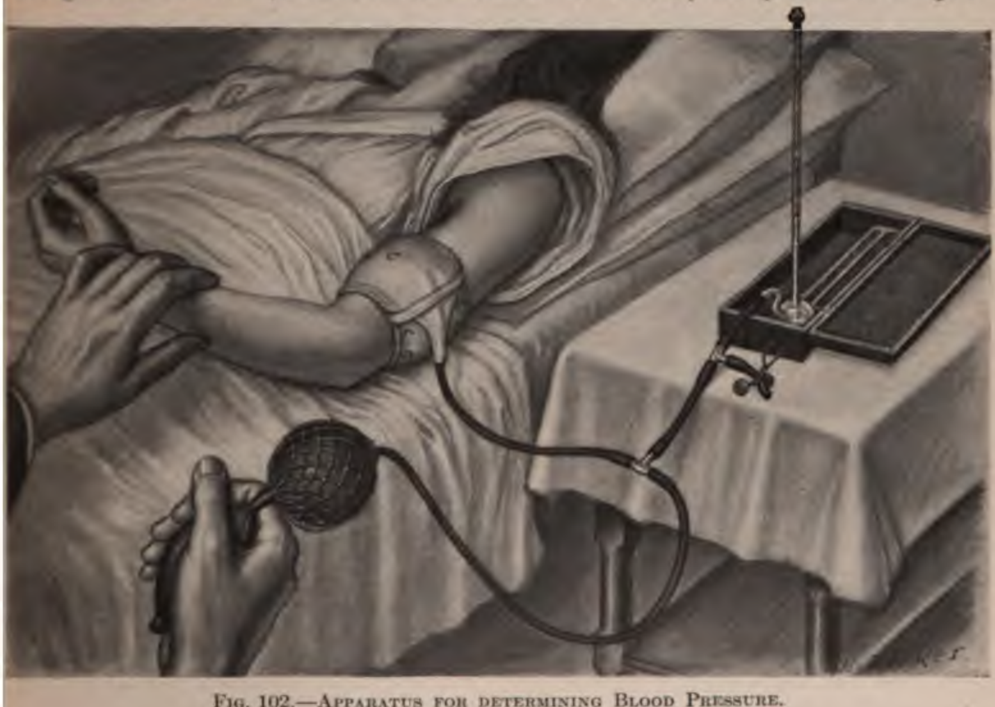


FIG. 102.—APPARATUS FOR DETERMINING BLOOD PRESSURE.

Fig. 102 shows the sphygmomanometer in position. When used during anesthesia the arm is stretched out to the side on a level with the head and rests upon the table, so as not to interfere with the field of operation. The apparatus consists essentially of three parts connected by rubber tubing: (1) A constricting, hollow rubber band, fitting snugly around the patient's upper arm; (2) a mercury manometer; (3) rubber bulb with valve attachments for inflating the arm piece. The pressure is raised in the arm piece until the patient's pulse is obliterated, the point of obliteration approximately representing the normal arterial blood pressure. The amount of this pressure is indicated by the mercury manometer.

The effect of anesthesia and operative manipulation upon blood pressure is shown in the accompanying chart (see Fig. 103). The blood pressure during the operation after the stage of complete relaxation is usually slightly above normal, varying from 120 mgm. to 140 mgm. A tension above 160 or 170 mgm. is accompanied by increased tendency to hemorrhage and may be causing undue strain on the heart or vessels. A falling tension points to hemorrhage, shock, or weakening heart. The pulse is scarcely ever perceptible with a tension below 40 to 50 mgm.

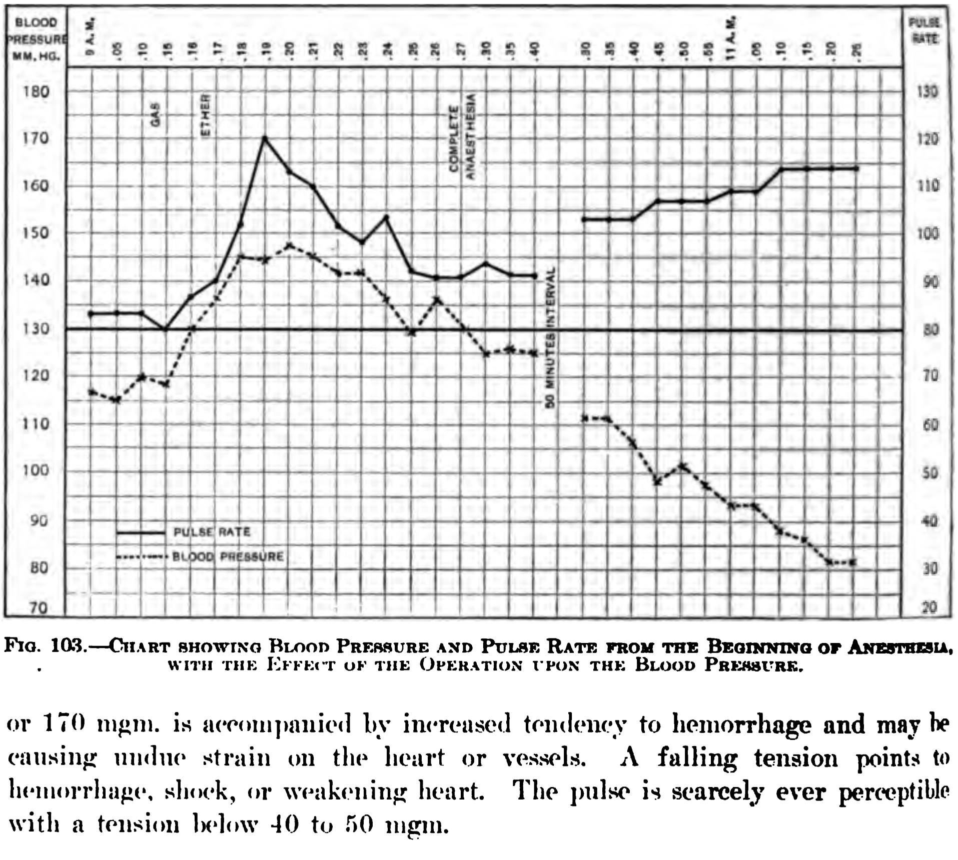


FIG. 103.—CHART SHOWING BLOOD PRESSURE AND PULSE RATE FROM THE BEGINNING OF ANESTHESIA, WITH THE EFFECT OF THE OPERATION UPON THE BLOOD PRESSURE.

NITROUS OXIDE ANESTHESIA.

Nitrous oxide gas when used alone is suitable only for short operations and for pelvic examinations where unconsciousness or relaxation during a brief period is desired. It is undoubtedly the safest of the general anesthetics, and if properly administered is practically without danger. Anesthesia with nitrous oxide is dependent to a certain extent on the narcotic action of the gas self, but probably in greater part on the deprivation of oxygen and the re- lting partial asphyxia. The gas is odorless and entirely non-irritating, so at the patient experiences no disagreeable symptom, except perhaps a brief umbness or tingling in the limbs preceding loss of consciousness. Uncon- iousness can usually be readily induced in less than a minute, and the return normal control of the faculties and muscles is almost as rapid, and unac- ompanied by any unusual or any untoward symptom. As a matter of fact, e sensations are usually of an agreeable character and may give occasion r the synonym of "laughing gas."

The gas is administered from a cylinder, where it is contained under pres- ure, and may be given directly through a tube introduced into the patient's outh, respiration through the nose being prevented by the anesthetist; or se indirectly by means of one of the several inhalers devised for this pur-

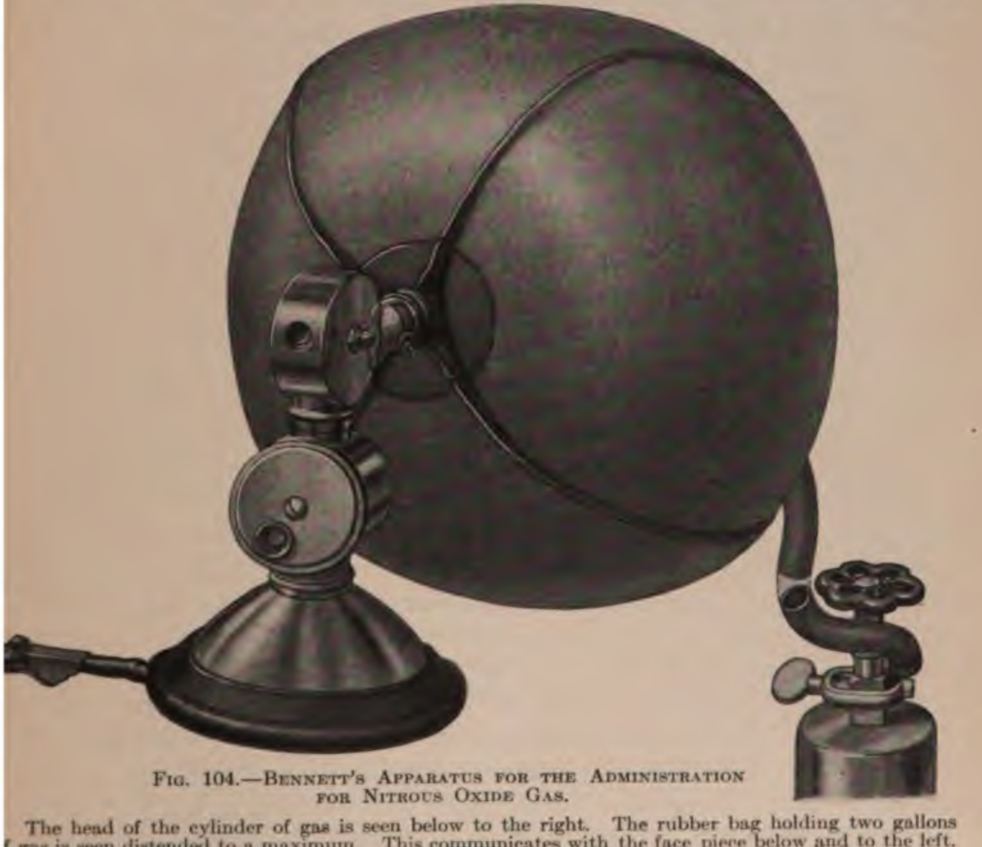


FIG. 104.—BENNETT'S APPARATUS FOR THE ADMINISTRATION FOR NITROUS OXIDE GAS.

The head of the cylinder of gas is seen below to the right. The rubber bag holding two gallons f gas is seen distended to a maximum. This communicates with the face piece below and to the left. he valves above serve to control the gas. The part of the apparatus just above the face piece is sed for the administration of ether.

ose. The one most generally used is that of Dr. Bennett (see Fig. 104). he essential parts of this inhaler are: (1) A large rubber bag which is in- lated from the cylinder; (2) a mouthpiece which fits closely over the patient's face; and (3) between the bag and the mouthpiece a metal box, which establishes two interchangeable methods of connection between them: one direct, for the passage of gas, the other passing through an ether-soaked sponge.

The usual method of anesthesia, when gas alone is to be used, is to fill the bag with gas and then allow direct to-and-fro breathing into the bag, gradually permitting more and more gas to enter from the cylinder as the bag collapses. The patient's color changes quickly to a bluish tinge, and occasionally she must be allowed a little air. Experience is necessary in judging just how deep to keep the asphyxia without risking too great a deprivation of oxygen, on the one hand, or, on the other, permitting the patient to return to consciousness. Associated with and probably dependent upon the asphyxia is a marked rise in pulse tension. When unconsciousness has been induced, a process which usually requires less than three minutes, ether or chloroform may be added, and later substituted, if prolonged anesthesia is desired. No especial care or after-treatment is necessary after the administration of nitrous oxide gas.

ETHER.

Washed sulphuric ether is universally understood under this title in America. Only the brand which is known to be the purest in the market should be used. Ether is very volatile, but this fact does not interfere with its use in warm climates, except perhaps under very extreme conditions. No trouble arises from this cause in a room at a temperature between 100° and 106° F.

The vapor is somewhat irritating to the air passages, and if too concentrated at the beginning of anesthesia may induce troublesome coughing or choking sensations terrifying to the patient. This annoyance can be largely prevented by beginning the anesthesia very slowly and taking pains to accustom the patient to the fumes of the gas; is entirely absent when the nitrous oxide-ether sequence is used. It is always best to give ether gently, soothing the patient and letting her grow gradually accustomed to the vapor as it is brought nearer and nearer to the face. A few minutes spent in this way will obviate entirely the necessity of forcing the patient down on the table and strangling her with the drug, a procedure which, if witnessed, will never be forgotten.

In the early part of the anesthesia only small quantities of ether should be used, and no attempt should be made to force the patient to take it rapidly. If the patient is told to breathe deeply, the respirations will continue full and regular, according to the suggestion of the anesthetizer, until her volition is overcome, when there is a cessation in the breathing which prevents the even administration of the ether. For this reason I think it is best to instruct the patient to breathe naturally, and only to command her to breathe deeply when she persists in holding her breath. By gradually bringing the inhaler nearer the face and allowing at short intervals a breath or two of fresh air, the disagreeable strangling sensation is avoided. It is an error to remove the ether as soon as she loses consciousness, whenever there is a disposition to vomit; the tendency to vomiting is best overcome by increasing the quantity of ether and getting her more completely anesthetized. A timid anesthetizer, by hesitating at this point, can harass an operator throughout a long operation.

Various styles of ether inhalers have been devised, but the towel cone, stiffened with paper, which is very simple, may be used with as great ease and as satisfactory results as any other. Except in the hands of an experienced etherizer, it is probably safer than the closer fitting and more complicated forms of apparatus, which usually induce a greater degree of asphyxia. A stiff piece of blotting paper or moderately heavy manila paper, 15 x 10 inches in diameter, should be covered with oiled muslin, and this in turn with a clean towel. The oiled muslin may be dispensed with if it is not at hand. This pad is then twisted into the shape of a cone and then pinned together. A moistened sponge or piece of cotton is lightly packed into the apex, and upon this the ether is poured.

Ether is a cardio-vascular stimulant, as is well shown by the increase in pulse tension and frequency during its administration, unless too long continued. This is especially striking when ether is given to a very toxic or ill patient, as the pulse will improve in character immediately, and often continue improved until near the end of the operation or after the anesthesia is finished. This stimulant action is independent of, although, of course, increased by, the stage of excitement and muscular exertions, and may last during an hour or more of anesthesia. The stage of excitement is more marked in men than in women and is apt to be especially troublesome in alcoholics. It is important at this stage to keep control over the patient's jaw so that it may not become locked and so oppose dangerous opposition to relieving any obstruction to respiration. In cases of high arterial tension, especially if associated with arterio-sclerosis, where rupture of a blood vessel or excessive strain on the already overburdened heart is feared, the increase in tension consequent on nitrous oxide or ether administration may be counterbalanced by some form of vaso-dilator, preferably one-half to one grain of sodium nitrite, given fifteen minutes before starting the anesthetic. No contra-indication exists to the administration of ether where a general anesthetic is demanded, except perhaps the presence of a bronchial inflammation or any condition where an increase in arterial tension may induce sudden exodus, i. e., pulmonary tuberculosis with recurring hemorrhages, aneurism, or threatened cerebral rupture. Here, as a choice of evils, the toxic action of chloroform as a vascular and respiratory depressant is probably preferable to the stimulant action of ether. In overdoses ether has a depressant action, shown by shallow respiration, weak pulse, pallor, and symptoms of collapse; but usually a large quantity of the drug is required before this action is made manifest; moreover, its onset is slow and furnishes ample warning to a watchful anesthetist.

Death during Ether Anesthesia.—The primary stimulant action of ether opposes the depressant tendencies of loss of blood and nervous shock occurring as the direct result of operative injury, so that except in prolonged etherization the patient's pulse usually retains a good quality. Fatalities which can be fairly credited to the effects of ether and not caused by the operation *per se* are rare, and are the result of one of three causes.

1. During the primary and secondary stages the patient may become asphyxiated by the jaws becoming locked, by the tongue falling back into the throat, or by a spasm of the muscles of respiration. Care and judgment in handling the patient during the beginning of the anesthesia should avoid such accident.

2. Cardiac dilatation. In patients with a high tension pulse, and more especially stout women who lead sedentary lives, the heart has frequently but little reserve force, and the increased strain of anesthesia, operative manipulation, or the abnormal position may cause more or less acute dilatation; under these circumstances, unless the condition is recognized and corrected, the heart may increase rapidly in rate and stop in diastole. The only fatalities occurring during my first 8,500 ether anesthesias were two women who died on the table with symptoms of acute cardiac dilatation. Where a pulse, especially one of high tension or in obese patients, increases in rate, without a corresponding fall in tension which would indicate hemorrhage or shock, cardiac dilatation should be suspected at once, and, if present, should be relieved by the administration of a vaso-dilator. It is very questionable how large a share in the responsibility of these cases falls upon the stimulant action of the anesthetic, for undoubtedly the larger part of the increased strain on the heart is produced by the operative manipulation and the position of the patient.

3. Very rarely the amount of anesthetic administered may be in excess, either in overconcentration or for too long a period, so that the depressant action becomes evidenced by shallow respirations and irregular pulse, which may finally end in death.

CHLOROFORM.

Only chloroform manufactured by perfectly responsible chemists should ever be used, owing to the increased dangers from adulteration.

The advantages of chloroform are in some respects greater than those of any other anesthetic. By its means we are able to bring the patient more quickly and more comfortably into a state of unconsciousness. She remains more quietly under its influence, and, as a rule, nausea is not so extreme as after taking ether. In my experience, however, the percentage of cases entirely free from nausea is as great after ether as after chloroform anesthesia. Out of 50 cases of chloroform anesthesia, 6 were free from nausea afterwards; and out of 200 cases of ether anesthesia, 28 were free. These advantages are more than counterbalanced, however, by the greater risk to life in using chloroform.

Chloroform is a powerful cardio-vascular depressant, producing a fall in pulse rate and tension, from the beginning of anesthesia. This depression when the vapor becomes too concentrated or in an especially susceptible individual is apt to produce a sudden, alarming, and occasionally fatal syncope. In such a case, without a moment's warning, and often at the beginning of the sthesia, the pulse may become thready, then imperceptible, and the respira- cease.

In addition to this inhibitory action, chloroform is a tissue poison and pro- es various degenerative changes, from hyalin to fatty, in the heart, kidneys, liver. It is thus particularly contra-indicated in all cases of lowered cular tone and in diseases of heart muscle and parenchymatous nephritis.

Operations must not be performed under chloroform during the stage of mary anesthesia, so frequently utilized for short operations under ether. ths have occurred in this way which were apparently due to sudden inhibi- of the heart from shock not felt in complete anesthesia. The quiet, even sthesia produced by chloroform is such an advantage in abdominal surgery t it would be indicated in all cases were it not for these dangers.

Rules for Administering Chloroform.—Extreme care should always be ob- ed in the administration of chloroform, as it is dangerous in every kind of except in childbirth, where the high arterial tension maintained during r apparently corrects the depressant action of the drug.

(*a*) A careful preliminary examination of the patient must be made as to dition of vascular and renal systems. A weak or laboring and dilated heart parenchymatous nephritis are contra-indications prohibiting chloroform.

(*b*) It is never right to assign the administration of chloroform to one who been accustomed solely to the administration of ether, and in no case should sthesia by chloroform be intrusted to a nurse, unless a responsible physician ps the patient constantly under his supervision during its use.

(*c*) Chloroform should never be given, except in obstetrical cases, without ndant help close at hand to resuscitate in case of asphyxia.

(*d*) The patient must not be disturbed in the early stages of anesthesia by nming doors, loud walking, or talking. I have seen a patient jump up refuse to take more when frightened in this way.

(*e*) Chloroform must be given from a graduated bottle containing a defi- quantity, a few drops at a time, on the inhaler, with an abundant admix- of air.

(*f*) The anesthesia must never be hurried, and, above all, the person giving ust not use the common exhortation, "Breathe deeply."

(*g*) The head must never be raised higher than the body, in order to rd against sudden anemia of the brain.

(*h*) If the patient vomits, the chloroform should be put aside and the jaw wn forward, by hooking the fingers behind the angle, and the face turned he side, until she is quiet again, when the anesthetic may be resumed.

(*i*) If the anesthetizer notes any alarming change in the patient's pulse, iration, color, or pupils, he must at once suspend the anesthesia, and, if condition persists, proceed to resuscitate.

(*j*) If the respiration becomes unequal or stormy, the chloroform must be nediately withdrawn, as there is no way of judging how much more of the g is being absorbed than under ordinary conditions of breathing.

The patient must be carefully and continuously watched after the anesthesia is over, until she becomes conscious, as she may die in this post-operative stage. When a patient does not rally well and promptly she should be watched with increased care, and stimulants in the form of external heat, stimulating rectal enemata, and hypodermics of digitalis and strychnin must be given. In such cases death has been known to occur several hours or longer after the operation.

The best method of giving chloroform is with the Esmarch inhaler. A few drops—not more than four or five—are poured on the flannel hood covering the little rounded wire frame, which is held at least five inches from the face. The patient should be slowly and gently brought under its influence by adding a few drops from time to time, and gradually bringing the inhaler closer to the face.

In case of difficult breathing arising from the root of the tongue dropping back in the fauces, the lower jaw must be seized behind the angles and pulled forward, producing subluxation, and the head at the same time extended, so as to bring the upper air passages and the trachea into line. (H. A. Hare's method, *Johns Hopkins Hosp. Bull.*, Jan., 1895, p. 1.) The practice of using much force in pulling the jaw forward is reprehensible; patients frequently complain for days of soreness at the angles of the jaw after this has been done, and I have seen parotitis occur as a result of the traumatism. If moderate force is not sufficient to draw the jaw forward, it should be protected with pads of cotton or gauze, or the mouth should be opened and the tongue pulled forward with a tongue clamp; but it is rarely necessary to resort to this measure.

Resuscitation of the Asphyxiated.—As soon as a pallid face, dilated pupils, a feeble pulse, and cessation of respiration are noticed, no time must be lost in proceeding at once to resuscitate the patient.

The operation must be instantly suspended, arteries in the field of operation whose lumina can be seen (for they will have ceased to bleed) must be temporarily clamped, and the wound hastily protected with sterilized gauze, while an assistant jumps upon the table, grasps the patient's legs beneath the knees, and lifts the body up to an angle of 40 or 50 degrees until it rests on the shoulders. In this way the blood gravitates down into the head and heart.

The surgeon takes his stand at the head, which lies extended over the edge of the table, and proceeds at once to establish artificial respiration by placing both hands behind the chest and drawing it toward him, producing inspiration; by the reverse movement, pushing backward and inward, expiration is produced. An assistant making pressure in the epigastrium prevents the effect of the respiratory efforts being lost on the abdominal viscera. The air can be heard rushing in and out, pulsation is soon felt at the wrist, at first feebly, then more strongly, the color becomes natural, attempts are made to respire, and in a short time the danger is past, when the operation may be resumed. If the pulse can not be felt at the wrist it may be found by feeling the abdomil aorta through the incision. If it is not felt there, the hand may press up rough the diaphragm and feel the heart directly.

Where the lower chest is contracted by the wearing of corsets and when e costal cartilages are calcified, this manipulation will not produce respiration, nd it is necessary to force air in and out of the chest by placing one hand n the middle or lower thoracic spine and the other on the sternum. Then, mpressing the chest, air is forced out, and by relaxing the pressure it rushes n again. In this way a regular respiration may be maintained until it is stablished voluntarily. The larynx can be kept open by hooking an index inger in it.

If it is necessary to resort to artificial respiration when there is not a sufficient number of assistants present to carry out the method just described, s may occur in private practice, the plan formulated by Dr. Sylvester should e followed. By this method the patient is quickly placed in position across he bed with a pillow or roll of clothing beneath the thorax. The surgeon, tanding at the head of the patient, grasps her arms at the elbows and draws hem upward and outward, describing a circle, until they meet above the head. his movement induces inspiration by expanding the chest through the agency f the pectoral muscles. After a pause of two or three seconds the arms are wept downward and outward to the sides of the chest, against which they are rmly pressed. This maneuver induces expiration by diminishing the capacity f the chest. The two movements should average eighteen to the minute.

NITROUS OXIDE-ETHER SEQUENCE.

The method of anesthetizing which I now use almost entirely is that of arting with nitrous oxide gas, and as soon as the patient is unconscious, administering ether gradually by the combination instrument of Bennett (see ig. 104, p. 194); I continue the ether anesthesia with this instrument throught the operation, or else substitute the simple ether cone as soon as relaxation complete. This plan saves from five to ten minutes of the ordinary ether nesthesia and almost entirely obviates the second stage of excitement. The atient becomes unconscious with a minimum of disagreeable sensation, the rangling and choking are absent, and the third stage of complete anesthesia nd relaxation is reached quickly and easily. Considerably less ether is reuired for complete relaxation.

ADMINISTRATION OF DRUGS DURING ANESTHESIA.

Perhaps in no other condition does there exist greater misuse and abuse of herapeutics than in connection with anesthesia and operation. In general it ill be found that the more skilled the anesthetist, the less will be the frequency and quantity of the drugs he will administer, and the tyro alone will eep the nurse busy preparing and injecting one hypodermic after another. It essential to have a correct knowledge of the therapeutic value of the drugs rdinarily employed and to use them when specific indications exist, and only then. Strychnin in doses of $\frac{1}{30}$ to $\frac{1}{20}$ of a grain to an adult has an excellent cardio-vascular stimulant action, apparently acting both upon the heart and vessel muscle and the nervous mechanism. Cocain in doses of $\frac{1}{8}$ to $\frac{1}{4}$ of a grain has a similar, though less marked and less lasting, action. Digitalin in doses of $\frac{1}{60}$ to $\frac{1}{20}$ of a grain, best given with strychnin, is of value where the heart muscle is at fault. Camphor is used to a certain extent abroad, particularly in France, and is a good cardio-vascular stimulant. Ergot acts directly upon the smooth muscle of vessel walls and will cause a rise in pulse tension by a peripheral constriction. Adrenalin acts similarly to ergot, but the action is very transient, and the administration, to be effective, must be intravenous and continuous as well as carefully regulated. Ether is a stimulant, and a hypodermic of it has occasionally been tried *in extremis* to excite action in a failing heart. Alcohol is a narcotic and a mild vaso-dilator but without any stimulant action. It is thus worthless for any immediate stimulant effect, but is sometimes valuable in after treatment as a heat and energy producer. Nitroglycerin is a vaso-dilator, hence it weakens the pulse, and its use should be restricted to cases of abnormally high tension where it is desired to soften the pulse. Of course it is contra-indicated in shock or other indications of depressed vascular tone. Sodium nitrite is the most valuable of the vaso-dilators, as the action, while similar to nitro-glycerin, is much more lasting and stable. Salt (sodium chloride) in normal physiological dilution (.6 per cent) is valuable in replacing blood lost by excessive hemorrhage. It is without any other specific stimulant action and is too frequently used subcutaneously during or after operation. In a rectal enema after operation it is valuable in assisting diuresis and supplying fluid which can not be taken by mouth. Caffein is a mild stimulant, and when needed may be added in the form of coffee to the rectal enema.

In a majority of cases drugs will not be needed when the anesthetic has been carefully given and the operative injuries are not extreme. The indications for their use may be stated as follows:

Hemorrhage.—While hemorrhage of any moment is occurring, the pulse tension will gradually fall, and the rate may rise, while the wave becomes smaller. It is best to reserve any stimulant measures until the hemorrhage has been thoroughly controlled by the operator. Otherwise the increase in pulse strength may cause greater tendency to bleed from the unprotected vessels. If hemorrhage is excessive from small vessels, and the operation made difficult by copious bleeding, an abnormally high pulse tension may be suspected. If this suspicion is verified by the sphygmomanometer, a vaso-dilator will lower the tension and lessen the hemorrhage. The subcutaneous or intravenous transfusion of large quantities of salt solution, 2 to 4 liters, have, apparently, saved patients after the pulse had become imperceptible in consequence of excessive hemorrhage.

Shock.—Where operative irritation has been extreme a certain degree of shock may develop during or after the operation, depending on the resistance of the individual and the extent of the injury. The first indication is a fall in blood pressure and later a rise in pulse rate. An examination of the area of cardiac dullness in both shock and hemorrhage shows no increase in its extent. Cardio-vascular stimulants are indicated and mechanical measures may be tried, such as abdominal compression or elevating the foot of the bed. In extreme cases ergot and adrenalin have been recommended.

Cardiac Failure.—This is especially apt to occur in cases of high pulse tension with cardiac hypertrophy, or in cases of low or moderate tension with a fatty or otherwise diseased heart. In both cases the heart is working with little or no reserve force and is apt to give way under operative manipulation. In the former a vaso-dilator and cardiac stimulant are indicated, in the latter merely a vigorous stimulant.

Anesthesia Depression.—When an overdose of chloroform has caused the respiration or the pulse to weaken or cease, immediate energetic action is necessary, and the physical measures described are more to be depended upon than drugs, as the circulation is so sluggish that little or no result can be expected even from hypodermic injections. Ether usually produces its toxic result more slowly, the respirations becoming more and more shallow and the pulse gradually weaker. Removal of the anesthetic and free cardio-vascular stimulation is indicated.

CHAPTER XI.

CONGENITAL AFFECTIONS.

1. Absence of vagina (p. 204).
2. Atresia of one side of the uterus (p. 208).
3. Vaginal septa (p. 208).
4. Double vagina associated with septate uterus (p. 209).

CONGENITAL affections are imperforate hymen (see Chapter XIV), absence of the vagina, atresia of the upper part of the vagina with bicornute uterus, double vagina, and vaginal septa.

ABSENCE OF THE VAGINA.

When the vagina is absent, the uterus, ovaries, and tubes are also usually either absent or rudimentary. The exact condition of the organs higher up must be determined by a bimanual examination under anesthesia through the emptied rectum and the abdomen; the examination may also sometimes be made by a finger in the rectum and a sound or a finger in the bladder. An operation attempting to establish a connection between rudimentary organs and the vulva can not be serviceable, and is therefore unjustifiable. It is also useless to attempt to form a deep pocket between the rectum and bladder simply for sexual purposes, as such an opening can not be maintained.

Transplantation for Atresia of the Vagina.—An absent vagina may be replaced by the transplantation of new vaginal tissue from a case of prolapse, when the uterus, tubes, and ovaries are present, or when there is a unicorn uterus with hematometra and hematosalpinx. As W. Nagel has pointed out, in many apparently congenital cases the atresia of the vagina is really due to an unnoticed local inflammation in early childhood.

The formation of a new vagina has been twice successfully done by A. Mackenrodt (*Centralb. f. Gyn.*, 1896, No. 21, p. 546) as follows: A transverse incision is made in the septum between the urethra and the rectum, and the vesical and the rectal sides of the septum are separated from each other by a blunt dissection, with finger and instruments; on reaching the cervix both index
re inserted and the future vagina widened. The wound surface is now
mly with an iodoform-gauze tampon, which is changed every few days,
whole surface becomes covered with healthy granulations. At this
the transplantation is done, at either one or several sittings, according
amount of the tissue available to make the new vagina. Unusual
t be taken in preparing the flaps, which must first be carefully cleansed,

nd then cut out without crushing or bruising, and with as little as possible of he underlying connective tissue. The flaps are then put aside, wound surface wound surface, and kept warm and covered in a sterile dish until the proapse operation has been completed, when they are laid with great care on the ried aseptic wound surface and pressed down, until they adhere as if by sucon; they are then fixed in place by an iodoform-gauze tampon, which remains ndisturbed for about ten days, while the patient is kept absolutely quiet in bed. he replacement of the whole vagina at one sitting is more difficult. In this ase the flaps formed as described are spread out lengthwise on a Cusco's specuum, with the epithelial surfaces turned inward; they are then sewed together osely so as to allow any secretions to escape between them. At the inner end f the speculum they are connected by a few threads which form a loose pocket; en the upper end of the speculum is filled with iodoform gauze and inserted to the wound, and as the speculum is withdrawn, more gauze is packed in, ll in one piece, until the tamponade is completed. Especial care must be given keeping the tampon from being wet with urine. In two weeks the parts ppear normal.

When both the vagina and the uterus are absent and the ovaries are present nd functionally active, the recurring monthly paroxysms of pain, associated at mes with a vicarious menstruation, may necessitate celiotomy for the removal f the ovaries, as in the following case:

B. M. (No. 2190, Sept. 9, 1893), an anemic woman twenty-eight years old; t the age of twelve began to have periodical monthly severe headaches, acompanied by dizziness and flushes of heat over e entire body; her face flushed readily, and she as annoyed by frequent blushing; she also had arp, cutting pains in the region of the left vary; between the attacks she felt well. In her wentieth year she began to have convulsions, as any as four and five in a day. A hemorrhagic ischarge from the rectum took place for the first me in her fourteenth year at one of the periods. he flow was dark brown in color, clotted, and not ffensive, and continued one day; after this there as no discharge for three years, but the feeling f fullness and pain in the abdomen still recurred very month. In her seventeenth year she had a econd hemorrhage from the rectum, which connued for six weeks. During the convulsive ttacks, which persisted at variable intervals, she ecame weak and nervous, and the abdomen was wollen and tender. Six months before entering the hospital the rectal flow egan, and continued, with the exception of a few days, up to the day of operaion, accompanied by much pelvic pain.

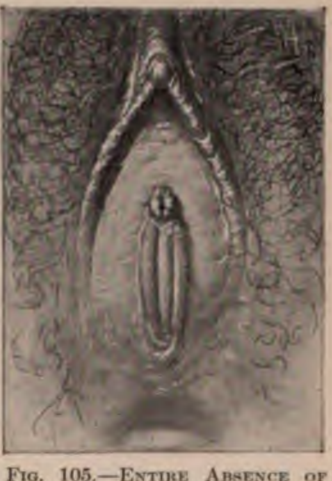


FIG. 105.—ENTIRE ABSENCE OF THE VAGINA, WITH INDICATION OF DOUBLE HYMEN. THE EXTERNAL GENITALS NORMAL. SEPT. 9, 1893.

Examination.—Scanty growth of pubic and vulvar hair. Escutcheon of the female type. External genitalia perfectly formed, rudimentary hymen, and the vagina entirely absent, being represented by a narrow fibrous column which could be palpated by the rectum.

Both ovaries and tubes were apparently normal, but seemed to fuse into two nodular masses corresponding to the cornua of a uterus; no uterine body could be felt.

Diagnosis.—Total absence of vagina and uterine cervix; two rudimentary uterine bodies; ovaries and tubes normal. Menstrual molimina with rectal discharge.

Operation.—Celiotomy for the removal of undeveloped uterus, ovaries, and tubes. The bladder lay transversely across the anterior part of the pelvis, and the small intestine with the rectum filled the posterior two-thirds. On the pelvic floor a fleshy nodule, 1.8 cm. in diameter, was found in the median line, from which a well-formed uterine tube extended out and up to the brim of the superior strait on the left side, terminating in a fimbriated extremity beneath which lay a small ovary.

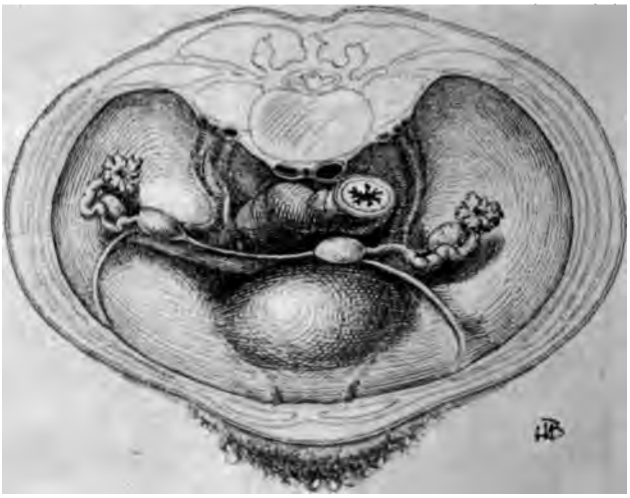


FIG. 106.—RELATIONS OF THE RUDIMENTARY UTERI, THE TUBES, AND THE OVARIES IN THE CASE OF ABSENCE OF THE VAGINA.

The left uterine nodule lies upon the bladder near the median line, the right nodule is close to the pelvic brim, and the two are connected by a thin fleshy band. Note the large oval made by the round ligaments. Operation for vicarious rectal menstruation with extreme nervous discomforts.

This central nodule was connected by a fold of peritoneum with a second similar but smaller nodule on the right side. From this nodule also a uterine tube extended out to an ovary. Both tubes were patulous down to the fleshy nodules, from which well-formed, round ligaments extended out to each inguinal canal.

A fibrous band about 4 cm. long, about 5 mm. broad, and 2 to 3 mm. thick, extended down under the bladder, representing the vagina. The rudimentary uterine cornua, tubes, and ovaries were removed and the patient made a good recovery.

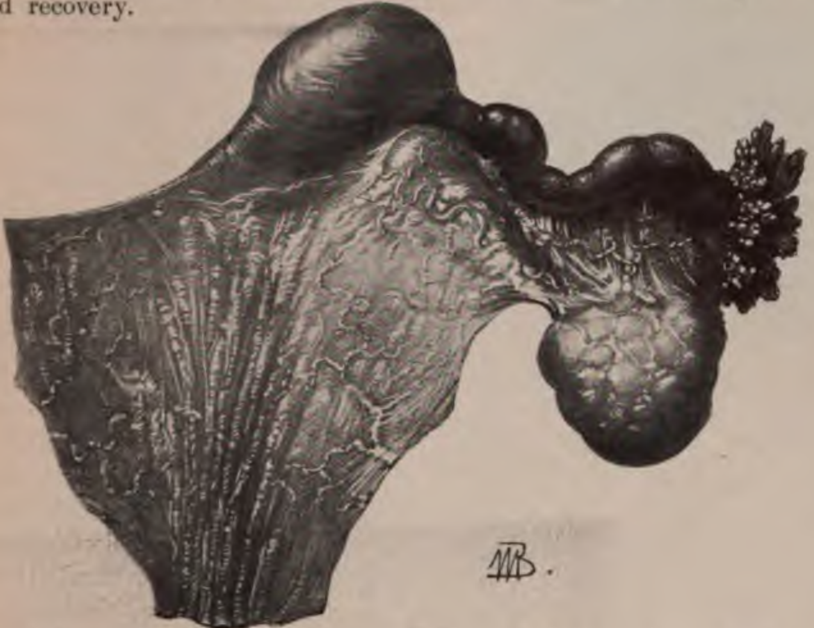


FIG. 107.—LEFT TUBE AND OVARY AND UTERINE NODULE, THE TUBE AND OVARY NORMAL IN SIZE.

The membrane below, with parallel folds, occupies the position of the uterine body and the upper vagina. SEPT. 9, 1893, No. 54. Natural size.

Microscopical Examination.—Tubes normal, well developed, nothing atypical in their histology. They end in two *culs-de-sac* in fleshy nodules slightly larger than the tubes and containing some normal uterine mucosa and glands.

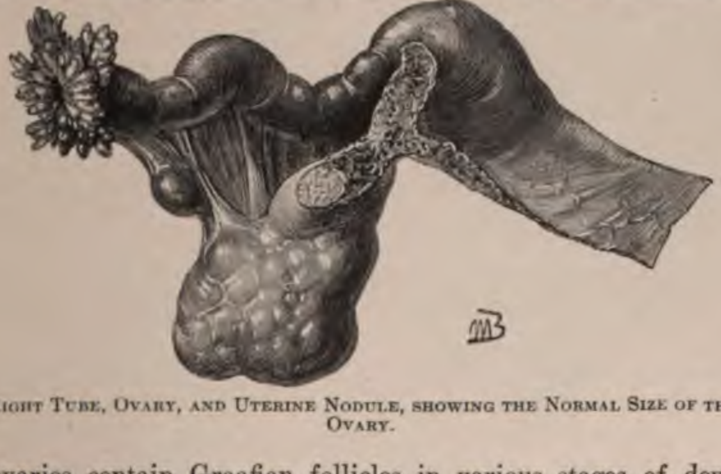


FIG. 108.—RIGHT TUBE, OVARY, AND UTERINE NODULE, SHOWING THE NORMAL SIZE OF THE TUBE AND OVARY.

The ovaries contain Graafian follicles in various stages of development. Corpora lutea and corpora fibrosa are present.

Diagnosis.—Rudimentary bicornute uterus, absence of cervix and fundus of uterus, normal ovaries and tubes.

ATRESIA OF ONE SIDE OF THE UTERUS.

Another form of congenital atresia is that which affects but one horn of a bicornute uterus. The menstrual secretions are here retained on one side, and, as the accumulation increases, a pelvic tumor is formed, bulging into the vault of the vagina on the defective side, where there is a distinct ovoid swelling, more or less tense and fluctuating to touch, displacing the uterus toward the opposite side.

Treatment.—The treatment of this form of gynatresia is by making a cruciform incision followed by evacuation and thorough irrigation, the most rigid aseptic precautions being observed during the convalescence.

VAGINAL SEPTA.

Septa when congenital are usually found in the upper part of the vagina. They appear as falciform processes, involving only the mucous membrane and encroaching upon the lumen of the canal. The cervix may be entirely hidden and the avenue of communication from the vagina below to the vault above may be but a small orifice placed at one side.

Sometimes the septum extends transversely across the entire vagina, forming an atresia, as in the case shown in Fig. 109.

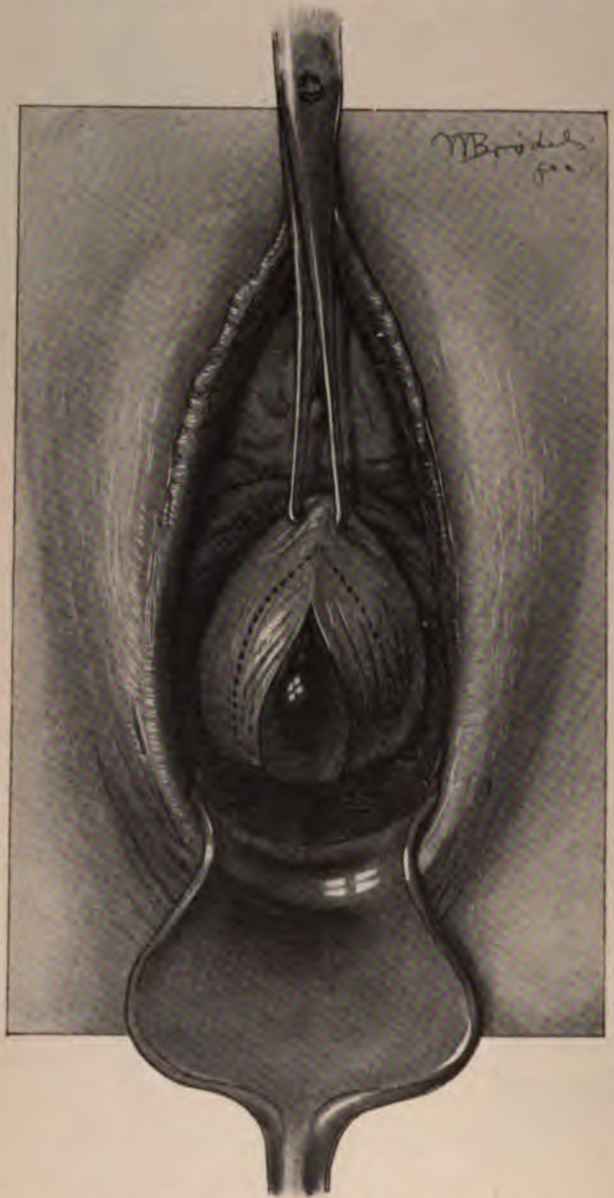


FIG. 109.—TRAUMATIC ATRESIA OF THE VAGINA WITH ACCUMULATION OF THE MENSTRUAL SECRETIONS ABOVE.

A median incision allowed the thick, tarry blood to escape and accumulate in the speculum as shown. The membrane was then excised along the dotted line. DEC. 5, 1896.

Such septa may mechanically cause sterility. They may also act as pockets n which irritating secretions are retained. The treatment is simply to divide the septum with a scalpel in one or two directions down to its base, without an anesthetic. If the septum is thin and membranous, no sutures will be needed; if fleshy and bleeding at the base, two or three fine silk sutures at this point will draw the upper and lower surfaces together and stop the low. These septa must not be confused with the acquired cicatricial septa, which need a different treatment.

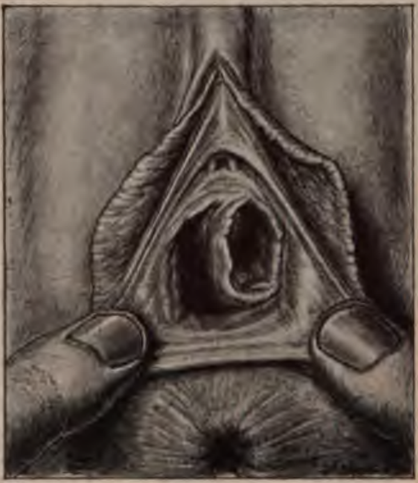
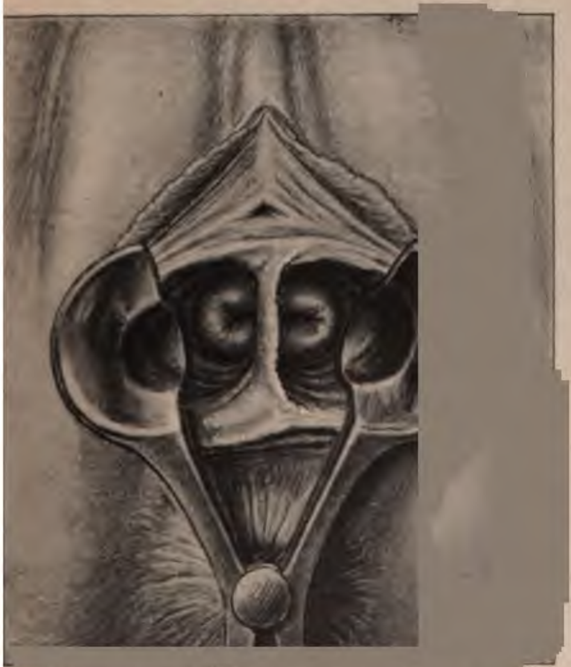


FIG. 110.—DOUBLE VAGINA WITH A THICK FLESHY SEPTUM. THE LEFT ORIFICE IS OVAL, WHILE THE RIGHT IS CRESCENTIC. DEC. 28, 1896.

DOUBLE VAGINA
(Associated with a Septate Uterus).

When there is a fusion of the Mülerian ducts without the absorption of the septum, uterus septus and double vagina are formed. These cases are not rare, and often present a history like the following: M. C. (No. 4887, December 28, 1896), aged forty-one, married twenty-six years; iii-para; labors difficult, but not instrumental; three miscarriages.



IG. 111.—DOUBLE VAGINA AND DOUBLE CERVIX, WITH A BLADE OF A BIVALVE SPECULUM INTRODUCED INTO EACH SIDE SO AS TO SHOW BOTH CERVICES AND THE SEPTUM IN THE MIDDLE.

Menstruation began at fifteen, regular, moderate, lasting two to three days, always with much pain.

Examination. — External genitals normal; hymen beginning on left side below urethra around to posterior margin is intact, beyond this on the right side broken in three places, leaving carunculæ between.

A prominent bridge of tissue extends from a point 1 cm. below the everted urethra to the posterior margin of the hymen, where it curves upward and joins the hymen on the left side. This bridge between the anterior and the posterior walls is thick and fleshy, looking like normal vaginal tissue. It begins on the anterior wall 1.5 cm. broad, is about 5 mm. broad in the middle, and 2 to 3 mm. in width where it joins the left side of hymen. Two vaginal orifices are formed in this way, the left crescentic, with the lower sharp horn of crescent encroaching on the left side; the right opening oval, 3 by 2 cm. in size when held slightly apart. The redundant vaginal walls pout into both of these orifices.

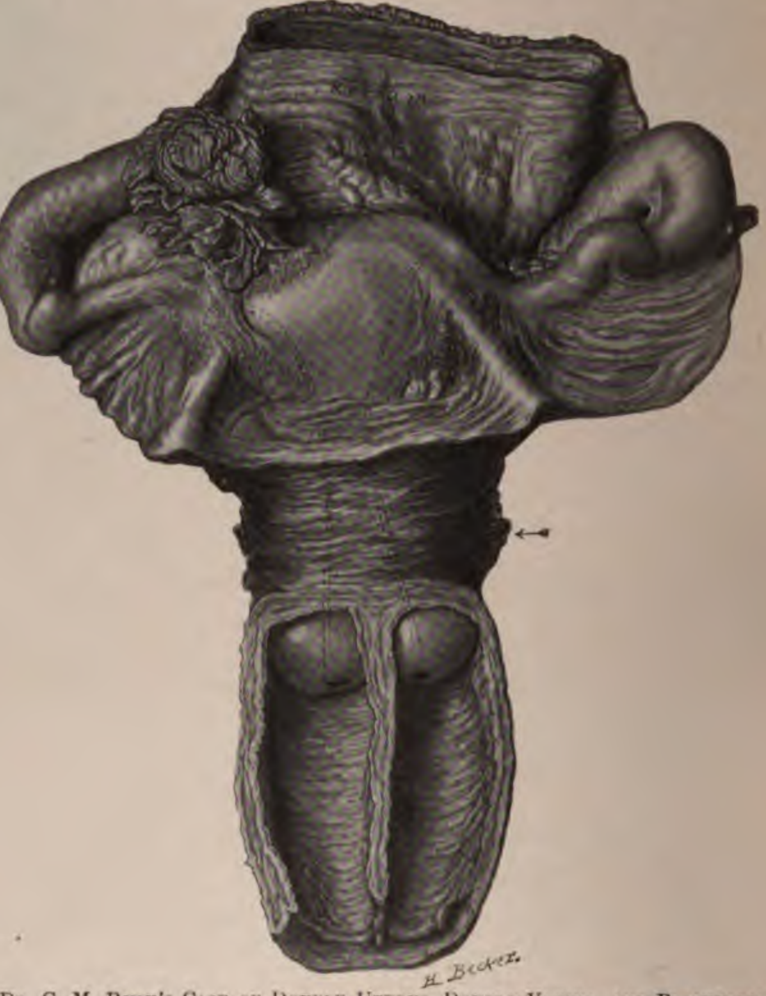


FIG. 112.—DR. G. M. RUSK'S CASE OF DOUBLE UTERUS, DOUBLE VAGINA, AND PLANIFORM FUNDUS.

The uterine cavities are shown in double lines. The arrows indicate the point at which the section for the next figure was made. ([illegible] natural size.)

The vaginal introitus looks as if the right side had been broken down and its folds smoothed out by labor, while the left side remained intact. This doubling of the vagina, apparent at the orifice, is continued all the way up to the flattened double uterine cervix, and upon introducing a bivalve speculum, o little cervices appear at the vaginal vault, one in each half of the vagina, th both openings turned toward the septum. The septum is not quite so ick above as below, and it measures about 3 from anterior to posterior wall.

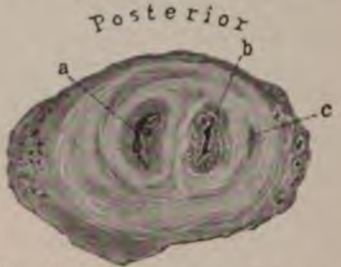
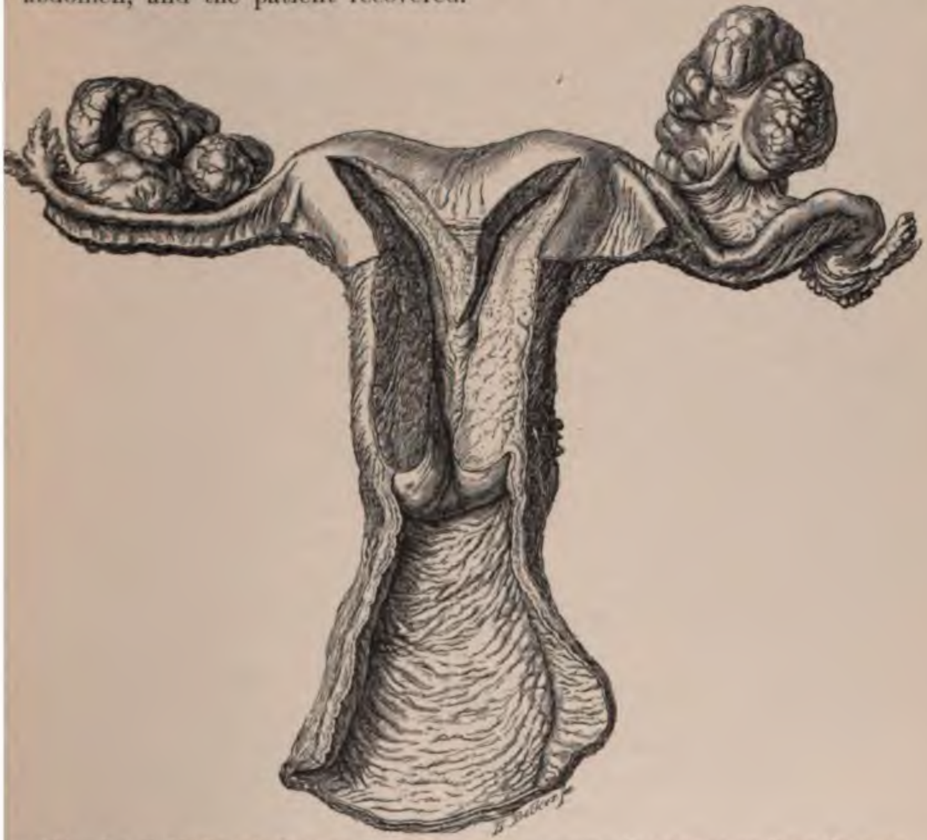


Fig. 113.—Section through the Cervices of the Uteri Above the Vaginal Vault.

a and *b* mark the right and left uterine cavities; *c* is Gartner's duct. (Natural size).

A diagnosis of pelvic abscess was made in case, and in order to evacuate it by the ina and to secure good drainage in a de- dent position, it was necessary to excise the re septum, and so unite the right and left inæ into one. This was done by cutting way with scissors at a little distance from vaginal walls. The bleeding was moderate easily controlled by a continuous catgut ire along the anterior and posterior vaginal ls.

An exploratory abdominal incision was then made and the vagina opened drained in the vault behind the cervices under guidance of the fingers in abdomen, and the patient recovered.



ig. 114.—Dr. G. M. Rusk's Case of Bicornuate Uterus with Carcinoma of Both Ovaries.
tum seen running down to the single cervical canal. The depression at the fundus is characteristic.

Fig. 112 shows a double uterus with planiform fundus, two distinct cervices, and two vaginæ drawn from a specimen furnished by Dr. G. M. Rusk.

Fig. 113 shows the same uterus in cross section. There is a common muscular investiture of the cervical canals which are, however, perfectly distinct and separated by a fibrous septum.

Fig. 114 shows a lesser degree of malformation in another case, also a patient of Dr. Rusk's, with carcinoma of both ovaries. The fundus shows a characteristic depression, and the strong fleshy septum is seen extending down to the region of the internal os. An examination of the cervix and vagina revealed no abnormality.

CHAPTER XII.

GENERAL PRINCIPLES INVOLVED IN PLASTIC OPERATIONS.

1. **Preparation** (p. 213): Rest. Bowels. Urine. Dress for operation.
2. **Operation** (p. 214): Position of patient. Washing of genitalia. Assistants. Irrigation. General principles. The operation. Dressings after operation.
3. **Care** during convalescence (p. 218): Position of patient in bed. Douching, if necessary. Catheterization. Care of bowels. Diet. Care of wound. Removal of sutures. Rest and tonic treatment. Hemorrhage following operation. Infection.

ALL plastic operations about the vulva, vaginal outlet, vagina, and cervix have certain common details, which may be considered in the following order:

1. Preparation for operation.
2. The operation.
3. Care during convalescence.

PREPARATION FOR OPERATION.

Every patient should be subjected to a thorough general physical examination before the performance of any gynecological operation, in order to exclude the possible presence of any obscure disease that might account for the condition of ill health. If the examination shows that an operation is necessary, and the general health of the patient is much impaired, a **rest** of a week or more in bed will hasten the convalescence, toning up the system and quieting the mind. Such a preparation is especially valuable in the case of nervous women. Constipation, which is obstinate in many uterine affections, should be overcome by a purgative, the continued use of mild laxatives, and a light but nourishing diet should be given. If there is loss of appetite, a simple tonic, uch as tincture of nux vomica, calumbo, or gentian, is often helpful. Women ith marked debility will be benefited by massage, cold baths, and electricity. When, however, the general health of the patient is good and she is clearly ffering from purely local symptoms, the preliminary period of rest and tonic eatment may be dispensed with, and the operation may be done with but one two days preparatory treatment.

The older gynecologists invariably put their patients under a protracted urse of preparation for an operation, while the present rule is to operate mediately and to build up the patient during her convalescence.

Immediately preceding the operation the bowels should be carefully evacued, so as to avoid disturbing them for at least two days afterwards. To insure orough purgation, ʒij of compound licorice powder, or a similar amount of gnesium sulphate, should be administered (both morning and evening of the day before), followed the next morning at six o'clock by a warm enema of a pint of soap and water. If the patient is delicate, a mild purgative, such as a pill of aloes, strychnin, and belladonna, or the solution of citrate of magnesium, ℥viij, may be given with good effect. The enema should be given quite three hours before the operation, regardless of the effect of the purgative, as it is essential to have the rectum and sigmoid flexure clear of feces. The action of an enema given later than the time specified is often delayed until the operation is under way, when the surgeon may be annoyed by the constant ejection of semi-fluid feces over the gauze diaphragm in front of the buttocks.

The urine must always be carefully examined both chemically and microscopically before operation. An advanced diabetes is a contra-indication to any surgical operation. I have, however, succeeded in closing a complete rupture of the perineum in a patient who was markedly diabetic, and she made a good recovery and lived for some years after. Nephritis in its early stages does not materially decrease the patient's chances of recovery. If, however, the constitutional and local symptoms indicate advanced nephritis, the operation should in no case be performed. I would also never wittingly perform a plastic vaginal operation in the presence of an inflammatory disease involving the tubes. I once let myself be overpersuaded in this matter and I lost my patient's life from a general infection.

The early morning is the best time to operate, when the surgeon feels fresh for his duty and his hands are free from the contamination of his daily work; the patient should also have a good night's rest, insured if need be by a mild sedative. The evening before operation the patient should take a hot bath, and immediately go to bed. The following morning, after the enema, the vagina should be thoroughly cleansed with a douche of carbolic acid solution (2 per cent), or boric acid (32 grams to the liter), at a temperature of 110° F. As a rule, no food of any kind is given on the morning of the day of operation. If, however, the patient is weak or feels faint, a glass of warm milk, or a cup of tea diluted with milk, may be given.

The patient's dress for operation consists of an undervest of warm flannel in winter, or of gauze in summer, a nightgown open up the back, and a pair of long woolen stockings. The hair is most conveniently dressed by plaiting it in two braids.

If the operation is to be performed in a private house, the patient should be anesthetized in a room adjoining the one selected for the operation; in a hospital the anesthetizing room is always separate from the operating room.

THE OPERATION.

The Position of the Patient.—The operating table is covered with a blanket protected by a sterilized sheet, and upon this, at the end of the table upon which the buttocks are to rest, is placed a rubber perineal drainage cushion (see Fig. 115). The buttocks rest squarely upon the cushion, projecting slightly over the

ge of the table, and the legs and thighs are held flexed upon the abdomen by
leg holder which is either attached to the table or is fastened as a broad band
st above the popliteal space, passes up under the shoulder, around the neck
d down to the opposite side,
ere it is similarly buckled above
popliteal space. When the
tient is thoroughly under the
sthetic this leg holder simply
ains the legs, without cramp-
them, and the knees fall apart
urally without the assistance
the leather crutches and bar so
ch used in the past. The arms
the patient should be folded
oss her breast and retained in
position by drawing the skirt
the undervest well up over the
ows. The nightgown should be
bed up under the small of the
k above the drainage cushion.
The external genitals are thor-
ghly soaped and shaved up to
mons veneris. An aseptic
or (Martin, Robb), with a short
d metal handle devised for this
rpose, is useful. After shav-
, the genitals should again be
roughly washed with soap and
ter. Green soap or soft soap
ves admirably for the purpose;
can be thoroughly rubbed into
skin, cleansing better than
rd soap. All furrows between the labia and about the clitoris must be care-
lly cleansed.

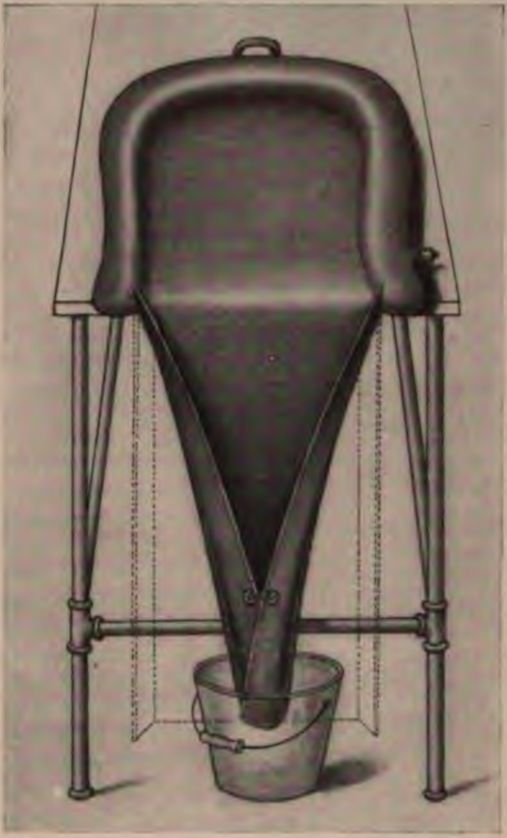


FIG. 115.—PERINEAL DRAINAGE CUSHION WITH INFLATABLE RUBBER RING, IN POSITION ON TABLE TO RECEIVE PATIENT IN LITHOTOMY POSTURE.

After the external parts have been cleansed, the assistant takes a pledget of
ton covered with soap, and introducing it into the vagina with long forceps,
der a stream of water from the irrigator, smooths out all furrows and scrubs
roughly all accessible parts, so as to remove the discharges and accumulated
thelial *débris*. Then the vagina is douched with a 10 per cent creolin
ution, which sterilizes, and acts as an efficient detergent. This solution is
lowed by a bichloride of mercury solution (1–2,000), and this again by
rm water. A thorough vaginal cleansing will require from three to five
nutes.

Long sterilized canton-flannel stockings are now drawn over the patient's legs and fastened above the knees with a drawstring. A protector 1 meter (1 yard) square, composed of two thicknesses of gauze, is spread between the thighs, covering all the exposed parts, and hanging well down over the buttocks onto the cushion; as the surgeon takes his seat he cuts a small opening in the protector corresponding to the vulva so as to expose the field of operation.

Assistants.—For convenience of rapid work the surgeon will do best with four assistants—one to give the anesthetic, two standing on either side of the patient to help the operator, while the fourth hands the instruments and ligatures as wanted. In operations conducted in a private house or private hospital the operator can make shift with two assistants—one to give the anesthetic and one to assist him directly.

Irrigation.—Irrigation by a continuous stream of warm water directed over the field of operation affords an excellent means of removing the blood, leaving the line of incision and denudation constantly clear. A glass reservoir holding several gallons of water should be placed on a shelf, at an elevation of five feet above the operating table. The rubber tubing from the reservoir, when not in use, should be coiled and kept immersed in a 5 per cent carbolic solution. It is best to regulate the flow by a glass douche nozzle, an Esmarch's hard rubber stopcock, or an efficient ball-and-socket nozzle, all of which can be easily detached for sterilization.

The assistant on the right hand of the patient takes charge of the irrigation, and keeps the area upon which the surgeon is working free from blood.

In vaginal hysterectomy a normal salt solution (.6 of 1 per cent) should be used; it is not irritating and does no harm even though it enters the peritoneal cavity. Sponging with small pledgets of gauze frequently changed is a good way to keep the field clear, one much more widely used to-day than irrigation.

The Operation.—The following general principles should control all plastic work:

1. Perfect exposure of the field of operation and the utmost ease of access to it. To accomplish this end it may be necessary to incise deeply a narrow vulvar orifice in order to reach the vaginal walls above. The field of operation can sometimes be seen to best advantage with the patient in the dorsal position and the thighs flexed; at other times, Sims' position (right or left dorsal) gives the best view; in others, again the genu-facial posture. It is not always possible to tell beforehand what position will be best adapted to a difficult case.

2. The field of operation must be minutely and carefully inspected in order to determine the very best plan by which to proceed. Occasionally I find it best to see and examine the patient with the utmost care several times before operating.

3. The operation must be conducted with deliberation and painstaking devotion to all the details. Success in plastic work depends upon the effective working together of all the factors, the exposure, the denudation, the suture,

etc. This deliberation must mark every step in the operation from beginning to end. Anything like brilliancy in plastic work denotes, not so much the able, as the vain and self-conscious surgeon.

4. At the close of the operation there should be a deliberate inspection of the whole field in order to ascertain that the tissues are well approximated without undue tension, and that all hemorrhage is controlled; in other words, that the surgeon has succeeded in accomplishing the result which he had pictured in his mind before the operation.

Just as the artist, with a few rapid strokes, sketches in the outline of his picture, so the surgeon will first outline his field of a plastic operation by incisions, marking its outer limits. This will enable him to judge more deliberately as to the amount of tissue to be removed; it is better, of course, to err on the side of a small outline than a large one, because a small outline may be enlarged so as to include more tissue, if found necessary. Outlining with the knife is especially important where scissors are to be used; the knife cuts a sharp line and the mucous surfaces then pull apart, permitting a rapid denudation with the scissors and subsequent accurate coaptation of the edges.

Bleeding is rarely active in plastic operations, the vessels being of smaller caliber. If, however, there is enough bleeding to annoy the operator, the vessels may be temporarily caught with artery forceps until the sutures are introduced. It is best to use pointed forceps and to crush the tissues as little as possible, as every bit of devitalized tissue lying in the wound area only increases the risk of infection. The finest catgut should be used to ligate vessels. A bleeding vein can be controlled by introducing one of the sutures approximating the parts, so as to grasp the vessel in its loop; this suture should be tied tighter than an ordinary approximating suture, so as to check the bleeding, and thus it serves the purpose of both suture and ligature.

The Tissues.—Yielding and vascular tissues are those best suited for plastic work; rigid, scarred, and non-vascular tissues are eminently unfavorable. Operation on inflamed or edematous tissues should also be avoided; a little more time, frequent irrigations, hot water applications, the use of a nitrate of silver solution, or even keeping the patient for some hours daily in a hot water bath will, as a rule, subdue the local inflammation and put the tissues in good condition. Dr. F. W. Sears tells me of a patient, seen by him in consultation, who had a suppurating recto-vaginal fistula following an unsuccessful attempt to close a recent complete tear. Dr. Sears refused to operate until the tissues were in healthier condition, although importuned to do so; another, more eager surgeon, however, consented, and the patient, a young woman in the twenties, lost her life in consequence. The surgeon, when next seen, remarked with emphasis: "You have taught me a lesson." Plastic tissues must be brought together, as far as possible, without tension. They should drop into approximation almost of their own accord. When deep sutures are needed to overcome the tendency in the tissues to pull apart, failure is the rule. Nothing so insures success as the snug approximation of the tissues; the deft surgeon shows his ability to best advantage by coaxing the tissues into easy approximation, where one less skillful finds it necessary to drag them together by force.

Dead spaces must always be avoided in plastic work; there must be no denuded areas left deep in the tissues which are not held in accurate approximation by sutures.

Sutures.—There are two ways of introducing sutures in order to secure union between planes of tissue. A single deep suture may be used, entering at one margin and emerging and reëntering at the opposite one, the entire depth of the wound area being thus embraced. G. Walcher (*Centralb. f. Gyn.*, 1896, Bd. 20, p. 269) has shown that in this method the suture must take a wide sweep out into the tissues away from the wound in order to secure an ideal linear approximation of side to side. A suture which simply skims under the denuded surfaces on both sides, only serves, when tied, to gather the tissues together in a pucker, forming, at the end, a stellate scar. A second way of securing accurate union, when dealing with opposing broad planes of tissue, is by buried catgut sutures (Worth); these may be either interrupted or continuous, and laid in one or more tiers according to the depth of the wound.

It is always well, whenever it is possible, to avoid bringing together three planes or three corners of tissue. Perfect union is rarely secured on the surface under such conditions.

The suture materials in use are, silkworm gut, silver wire, catgut, and silk. The silkworm gut suture is valuable on account of its elasticity and splinting properties, which it retains indefinitely in the tissues; it forms the best suture for bearing tension and for uniting together broad areas. The silkworm gut and silver wire offer the advantage of possessing no meshes for the lodgment of germs. The silver, indeed, is mildly antiseptic in the tissues, although, contrary to the expectations of Marion Sims, it has been largely discarded by surgeons. I employ a very fine wire, which can be tied like a thread in plastic work upon the vesico-vaginal septum, and I think that nothing quite equals it for this particular purpose. Silk and catgut sutures are most valuable for accurate approximation of the intervening tissues when the tension is borne by silkworm gut. In this way two kinds of sutures are often used in one case. The silk employed should be of the fine sort used in intestinal surgery. Heavy silk forms a seton, and affords a highway for the penetration of germs into the tissues, besides offering a shelter for the germs once entered from which they can not be dislodged. I would never bury silk at any point within the vagina. Catgut absorbs too quickly to be of use where there is tension, and it is also unfit for use in the neighborhood of a rectal wound because it forms such a good culture medium when moistened by the tissues.

Needles.—A needle must be selected which does the least possible damage to the tissues; and for this reason all large, clumsy needles with broad, cutting surfaces must be discarded. The best kind is a well-curved narrow needle, or a round one.

Dressings after the Operation.—At the end of the operation the vagina and external genitals are dried by pledgets of sterilized cotton. A strip of iodoform gauze may then be inserted into the vagina with the three-pronged packer as far up as the cervix, loosely filling the upper vagina and just appearing at the outlet; this should be taken out in five or six days and the vagina douched daily afterwards.

It is my practice at present to use no vaginal dressing at all, but simply to protect the vulva by a sterilized gauze pad held in place by a T-bandage. The pad is changed several times daily, and if there are any offensive discharges the vagina is douched out with a warm boric or carbolic solution once or twice a day. I have found a powder composed of boric acid, 3 ounces; alum, 1 ounce; carbolic acid, ½ ounce; and oil of peppermint, 1½ drams, a dram dissolved in a pint of warm water, very satisfactory in relieving the odor and irritation which are sometimes distressing during the convalescence from a plastic operation.

Before removing the patient from the table, draw the urine with a glass catheter, loosen the leg holder, and raise the buttocks by carrying the feet of the patient toward her head; dry the genitals, buttocks, and back with a towel, and remove the drainage pad.

The external genitals should be powdered with iodoform and boric acid (1–7), and then covered with a loose pad of sterilized cotton, held in place by a T-bandage.

CARE DURING CONVALESCENCE.

A nurse or doctor should remain with every patient, controlling any violent movements until she has fully recovered consciousness. In rectal and perineal operations it is not necessary to follow the old practice of restricting the movements of the legs with a binder after she becomes conscious. She may also be turned on her side if she wishes.

In perineal operations the bedpan must be used for two weeks and straining avoided. After cervical operations this restriction is not necessary, and cervical cases are required to stay in bed from seven to ten days only. If the patient can pass her urine voluntarily from the first she should be permitted to do so.

The vaginal pack is removed when a discharge appears externally, and when the discharge continues a douche is necessary; it should be given once or twice daily with the greatest care, to avoid pressure of the nozzle on the wound. A trained nurse, or the physician himself, should attend to this duty, for it has not infrequently happened that an unskilled nurse or an ignorant attendant has thrust the point of the syringe through a recently repaired perineum.

The nurse should be instructed how to separate the labia and expose the outlet with one hand by pushing downward and backward without making traction on any sutures. Secretions are now removed with pledgets of cotton held in the dressing forceps, and the blunt glass douche nozzle, gently poised between the thumb and index finger, is introduced in a direction backward and inward. Be careful to expel the air from the douche nozzle before it is introduced into the vagina. After the douche is given the genitals are dried with pledgets of sterilized cotton dusted with iodoform and boric powder (1-7), and covered again with a sterilized cotton vulvar pad. Under no circumstances should the hands come in contact with the field of operation. Except in cases of infection, douches should not be given earlier than the seventh day.

Catheterization.—A serious complication to be guarded against in all plastic operations is a cystitis caused by catheterization, and for this reason I wish to speak with special emphasis about catheterizing and the care of the catheter.

In skilled hands the glass catheter is best (see *Amer. Jour. Obst.*, 1889, vol. xxii, p. 184, and Kuestner, *Deutsch. med. Wochenschr.*, May 16, 1883). Immediately after use it should be rinsed in warm water, boiled for five minutes in a soda solution, and preserved aseptically, wrapped in sterilized gauze, or immersed in a bottle of carbolic solution (5 per cent), or formalin (10 or 20 per cent); or it may be stored in a glass ignition tube, resting on cotton and plugged with sterilized cotton. Metal catheters should not be used. Rubber catheters are safest in untrained hands; these are sterilized by keeping them in a carbolic solution (20 per cent); the catheter should be rinsed in boiling water before using.

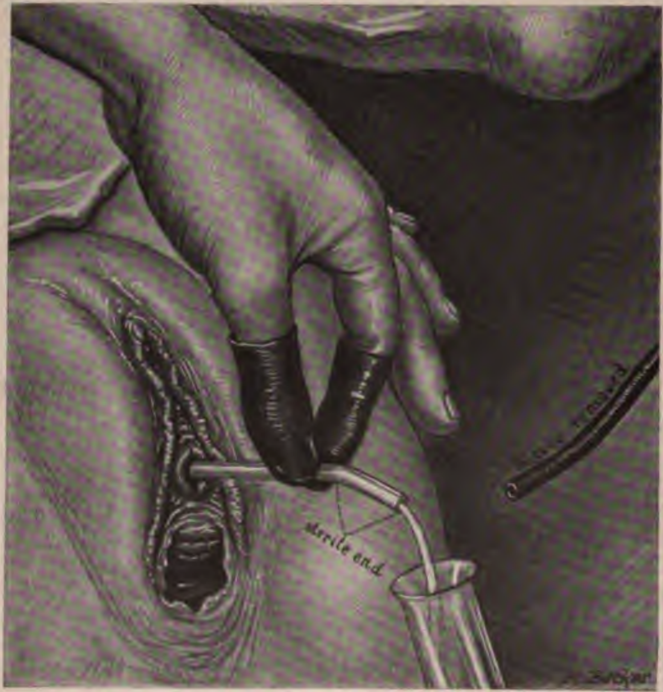


Fig. 116.

Shows the doctor holding the catheter with fingers protected by sterile rubber finger cots, while the urine escapes from the sterile end into the glass tube upon removal of the rubber protecting sleeve.

Catheterization must be performed in the following manner: The vulva is exposed under a good light, so as to bring the urethral orifice into full view upon separation of the labia with the thumb and forefinger of the left hand. Then, with the dressing forceps in the right hand, the parts immediately surrounding the urethra may be cleansed with pledgets of sterilized cotton saturated with boric acid solution; the catheter is now taken from its receptacle with fingers protected by sterile rubber cots, and without touching its vesical end; it is gently introduced into the bladder, no attempt being made in any way to control its direction, since it will follow naturally the course of the urethra. Before the catheter is introduced, its outer end must be stopped up by the finger, to prevent the urine dribbling over the parts. Finally the vulva should be dusted with iodoform powder and the sterilized T-bandage replaced.

Uncontaminated urine may be secured by protecting the outer end of the sterile catheter with a rubber sleeve, which is only removed after the urine has begun to flow as shown in Fig. 116.

Care of the Bowels.—On the second evening following the operation a pill of aloin, strychnine, and belladonna, or two drams of compound licorice powder, or a half dram of cascara, is given, followed the next morning, if necessary, by a soap and water enema. The custom of confining the bowels for eight or ten days is reprehensible. There is no danger of fecal matter gaining access to the wound, even where sutures have been passed on the rectal surface if they have been properly placed and properly tied. There is likewise no danger of disturbing united wound surfaces by the downward displacement of the pelvic floor during defecation on the third or fourth day following operation, if the feces are soft or fluid. When the bowels are confined for a longer period, there is often great difficulty in securing a movement, and the effort to pass the scybalous masses is now attended with real danger, because the sutures have become loosened and the union of parts is not sufficiently firm to withstand the pressure. In cases of complete tear a special diet is given and the bowels are locked for from seven to ten days (see Chapter XV).

Only a trained nurse or the surgeon himself should give the enema. I have known an inexperienced person to push the nozzle of the syringe through the coats of the bowel and force the injection into the pelvic cellular tissue. In one case I knew a nurse to push the end of the syringe through the stitches of a ruptured perineum and inject into the vagina. The most convenient position for giving the enema is with the patient lying on the left side. If a scybalous mass blocks the rectum the surgeon must himself introduce his index finger, break it up, and hook it out, making pressure in a direction away from the wound. When the bowels are once thoroughly opened, they should be kept open by a mild laxative, or an enema given every other day.

Diet.—No food is given until the patient has recovered from the nausea following the anesthetic. After from twelve to twenty-eight hours the stomach is usually sufficiently settled to permit the retention of small amounts of liquid nutriment. It is best to commence with from 30–60 cubic cm. (1–2 ounces) of milk every two or three hours, followed in a day or two by light broths of chicken, beef, or mutton. If nausea is persistent, a nutrient enema should be given to sustain strength, consisting of 60 cubic cm. (2 ounces) of milk and the yolks of two eggs, with enough water to make 120 cubic cm. (4 ounces). Tea well diluted with milk, hot beef tea with the yolk of a raw egg stirred in, rice soup, koumiss, are usually well borne.

From the third to the seventh or tenth day soft diet is best—soft boiled eggs, sweetbreads, oysters, white meat of chicken, milk toast, rice, bread, mush, baked apples, and baked potatoes. After the seventh day full diet may be gradually resumed.

Care of the Wound.—Where the wound is entirely or partly on the surface, the chief point in its care is to keep all objects which might convey infection from coming in contact with it; for this reason neither the surgeon nor the nurse should touch the wound with the hands in the subsequent dressings. The removal of discharge and arrangement of the gauze or cotton dressings should be effected with sterilized forceps.

If there is free discharge, it should be removed once or twice daily with pledgets of cotton, followed by a light dusting of the surface with the iodoform and boric powder mixture.

The length of time during which the sutures should be allowed to remain varies both with their position and with the results aimed at. If the healing is uninterrupted, the skin sutures may be removed with safety on the eighth day. Those within the vagina should not be removed before the twelfth day, or even later, on account of the danger of separating surfaces not yet firmly united.

Cervical sutures of silkworm gut may remain in place almost indefinitely, and, if the operation has been one of combined cervical and perineal repair, their removal should never be attempted until the perineum is quite firm and sound again, in from four to six weeks.

In order to remove the sutures, the patient is brought across the bed, or, better still, placed on a table, with the buttocks toward a good light, and the legs flexed upon the abdomen. The dressings and any incrusted powder are removed by sopping the parts with a warm boric acid solution; if the field of operation is within the vagina it is exposed with specula or retractors. In removing cervical sutures a Sims speculum is inserted and the posterior vaginal wall retracted, while the anterior wall is elevated by a narrow flat retractor. The first suture seen is caught with forceps and pulled upon until its loop comes into view, which is then cut and the suture withdrawn. The remaining sutures are found by displacing the cervix first to one side and then to the other. Sutures upon the floor of the vagina can not always be readily exposed, and are often best located by touch and then grasped with forceps and removed.

Stitches on the rectal side are readily removed by drawing them through the fenestrum of a rectal speculum which is pushed into the bowel, exposing the line of union, as practiced by Dr. G. M. Tuttle, of New York. Care must be taken in cutting the loop not to cut off both sides at once, as a loop thus left in the tissues will invariably cause persistent irritation and discharge, and must be removed sooner or later.

Rest and Tonic Treatment.—A patient upon whom a minor plastic operation has been performed should remain in bed for two weeks or longer, both for the purpose of securing firm union of the tissues, as well as for the equally important purpose of building up the nervous system and recruiting the general health. Advantage should be taken of the opportunity to keep neurasthenic patients in bed eight weeks or longer, giving them at the same time the benefit of a rest cure. From the fourteenth to the eighteenth day, depending upon the general improvement in symptoms, the patient may be permitted to put on a light wrapper and sit in a reclining chair or lie on a couch in sunny parts of the room. By the twentieth day she may resume her lighter duties, gradually increasing them during the succeeding days, until she has returned to her customary routine of work. The tendency of our hospitals is to make the stay of poor patients too short and to hurry them home.

It is a serious error to consider the function of the surgeon at an end when the wound is well healed and the operation in a technical sense successful. Patients who have long been in bad health before operation should be kept under observation for months afterwards, for the purpose of directing exercise, diet, and tonic treatment. Suitable exercise should be regularly and persistently taken, short daily walks in the open air, and rubbing down with alcohol or cacao butter on going to bed. Morning and afternoon the patient should rest for an hour on the back. Gymnastic exercises are not necessary, and exhausting exertion, such as shopping and dress fitting, must be avoided. Such tonics as tincture of nux vomica and the preparations of hypophosphites combined with cinchona often encourage a poor appetite. Koumiss, malt extract, or malt and milk, are valuable aids to the ordinary diet. One of the best therapeutic agents is a complete change of air for two or three months—in winter to a warmer climate, in early spring to the seashore, or in summer to the mountains.

In all of these cases it is absolutely essential to a perfect recovery to relieve the patient's mind of anxiety; for this reason the burdens of her regular duties, whether social or domestic, must be cast off or lightened as much as possible. As a general rule, the sexual relation should be prohibited for three months after plastic operations involving the vagina, and should then not be permitted oftener than once a week.

Hemorrhage following Operation.—An active hemorrhage is occasionally seen after a vaginal operation; it usually arises within the first week and persists for twelve, twenty-four, or forty-eight hours, or even longer, if unchecked. Such bleeding, while rarely threatening life, is always an annoying complication on account of the difficulty of access to the bleeding point; it also renders the patient profoundly weak and anemic, and prolongs convalescence. To control the hemorrhage, bring the patient across the bed or on a table in the lithotomy position, with a good light on the parts. Withdraw the vaginal pack if there is one, and wash the vagina free of all clots; after the douche, elevate the anterior vaginal wall with a small speculum and expose the whole wound area, cleansing it with small pledgets of cotton until the bleeding point is found. A curved needle carrying a small silk suture is then passed deeply beneath the point and the suture tied, controlling the flow. When the circumstances are not favorable for such a prompt and direct treatment, a tampon of sterilized non-absorbent cotton must be applied in such a manner as to make pressure upon the whole wound area. After twenty-four or thirty-six hours the pack is removed, but if the oozing persists it must be again applied. A tight pack skillfully applied does not often interfere with the union of the parts.

Infection.—The symptoms of infection following plastic operations are similar to those which may arise from an infected wound anywhere in the body. Ordinarily they do not show themselves before the third day, and it may be even longer than that before the surgeon is able to differentiate clearly between the usual sequelæ of operation and an infected process. Fever is usually present, and the pain of beginning sepsis is lancinating in character, and extends from the labia down the inner thigh. When the patient locates pain in this region no time should be lost in discovering the seat of infection. If it is about one of the sutures, as is most likely to be the case, the suture should be removed at once, and if a pus cavity of considerable size is found, it must be freely drained. In the early stages, where the symptoms are suspicious but the seat of infection can not be accurately determined, the application of hot poultices will not only relieve the pain, but so hasten the inflammatory process that a definite diagnosis can be made.

Hot injections of a solution of bichloride of mercury (1–5,000) every four or five hours also gives relief. But this treatment should not be continued longer than forty-eight hours, on account of the danger of mercurial poisoning. If the whole wound looks red and angry, all the sutures must be taken out and the wound allowed to heal by granulation. Sometimes an abscess of considerable size forms laterally, near one or the other of Bartholin's glands; in this case an incision should be made directly into the cavity, as far as possible away from the seat of operation, so that the ultimate results of the operation may not suffer from the infection.

Very often, by taking out a single stitch, a small stitch-hole abscess will discharge and the trouble be over. The outcome of a bad infection, extensive in area, may sometimes be surprisingly good; I have seen a complete rupture of the perineum close by granulation with perfect control over the sphincter ani.

CHAPTER XIII.

DISEASES OF THE EXTERNAL GENITALS.

1. Advantages of superficial position for operation (p. 225): *a.* Hemorrhage easily controlled. *b.* Defects easily covered. *c.* Asepsis. *d.* Sutures.
2. Diseases of labia majora (p. 226): *a.* Lipoma. *b.* Hydrocele. *c.* Inguino-labial abscess. *d.* Pseudo-myxoma of the canal of Nuck. *e.* Hernia. *f.* Fibroma and myoma of round ligament. *g.* Condyloma. *h.* Carcinoma.
3. Diseases of labia minora (p. 235): Cysts.
4. Diseases of clitoris (p. 237): *a.* Adhesions and concretions. *b.* Elephantiasis. *c.* Sarcoma. *d.* Carcinoma. *e.* Cysts.
5. Diseases of Bartholin's glands (p. 246): *a.* Cyst. *b.* Adeno-carcinoma. *c.* Myxo-fibro-sarcoma.
6. Affections of the vulvar mucosa (p. 260): *a.* Cohesion. *b.* Pruritus. *c.* Tuberculosis of the vestibule.

ADVANTAGES OF SUPERFICIAL POSITION FOR OPERATIONS.

In considering the surgical diseases of the external genitals, we take up the affections of some five different structures—namely, the labia majora, the labia minora, the clitoris, the mucous membrane about the vaginal outlet, and the vulvo-vaginal glands.

There is no common principle other than contiguity uniting these diverse organs in their pathological affections, the list of which is but short, including neoplasms, elephantiasis, cysts, abscesses, and pruritus.

In spite of the situation of these organs upon the exterior of the body, they are so well protected by the thighs that they are but rarely subjected to violence. I have seen a case in which a hematoma was produced by the kick of a brutal husband; a girl of twelve was brought into the ward of the Johns Hopkins Hospital suffering from a severe hemorrhage, with a large hematoma of the perineum and left labium, the result of a fall astride a fence rail on which she had been standing. I know of instances in which the external genitals have been injured in young girls by sliding down balusters and striking a low newel post. In one case, in the care of Dr. Jacob Price, of West Chester, Pa., a vulvar laceration was produced by the horn thrust of an angry cow.

Operations upon the external genitals are among the simplest and least dangerous gynecological procedures, on account of the superficial, accessible position of the organs.

Hemorrhage, although often free, particularly in operations involving the clitoris, is always readily controlled. Deep sutures uniting the edges of the wound are usually sufficient to control the bleeding without the aid of buried ligatures. The free anastomosis of numerous smaller vessels is the means of effecting a rapid union of wound surfaces. It is also easy to cover up large defects created by the extirpation of tumors and neoplasms with the lax movable adjacent skin. Situated on the surface of the body, the wound is readily protected, and its aseptic condition easily preserved after operation; for this reason suppuration does not often occur.

For suture material I prefer silkworm gut as a tension suture, and fine silk or catgut for accurate approximation. The need for an absorbable material is not so great where the sutures can be so readily removed, but for greater convenience the subcuticular catgut suture is perhaps the best.

LABIA MAJORA.

Lipoma.—Lipoma, or fatty tumor, is one of the rarest gynecological affections; no writer has as yet recorded more than a single instance in his own practice. In the Johns Hopkins Hospital Reports, vol. iii, page 321, I collected all the cases I could find in the scattered literature, numbering only twenty.

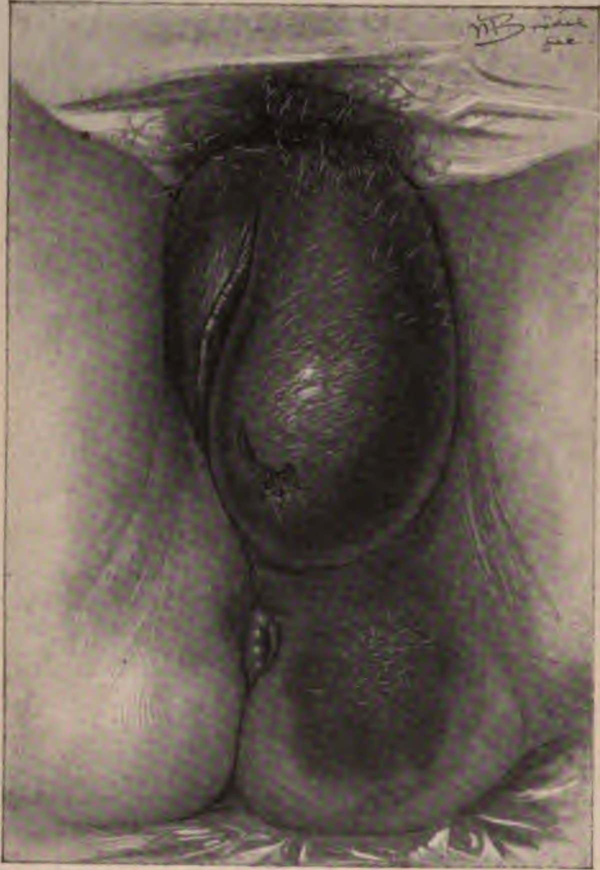


FIG. 117.—HEMATOMA OF THE VULVA OCCUPYING THE LEFT LABIUM MAJUS AND EXTENDING DOWNWARD ON TO THE PERINEUM.

The vaginal outlet is discolored and all of the surrounding parts distorted and infiltrated with blood. Below is an abrasion of the skin. The patient fell astraddle a chair.

Lipomatous tumors of the labia majora are usually easily recognizable, as they possess the same characteristics as lipomata elsewhere. The labium itself is enlarged when the tumor is attached to it by a broad base, or the tumor may hang by a pedicle more or less attenuated. In a case which I saw in the Episcopal Hospital, Philadelphia, an ovoid tumor, 8 cm. (3 inches) long, hung from the middle of the right labium majus by a slender pedicle 5 cm. (2 inches) in length and not more than 3 mm. in thickness. The pedicle of a large lipoma, on the other hand, may extend up into the inguinal canal, in which case the tumor simulates a hernia. The base of the growth has also been found extending back on to the perineum, or even up nto the vagina. The length of the pendulous growth in one case was 55 cm. 22 inches).

Dr. William Goodell, of Philadelphia, observed a case attached by a broad edicle hanging down to the knees. Balls-Headley, of Melbourne, removed a umor which weighed 24 pounds.

The lipoma feels hard or soft, according as the fibrous septa or the fat redominates. When there is an excess of fat, the sense of fluctuation is so istinct that the inference that the tumor is cystic is almost irresistible. Under his impression Goodell inserted an exploring needle into his case.

It is easy to mistake such a mass for a hernia, where the pedicle is broad nd extends up into the inguinal canal, and where there is impulse on coughing, ogether with some apparent reduction on manipulation and upon lying down, s has been recorded.

Age is not an important factor; the youngest patient I have found noted was eighteen, and the oldest, operated upon by Dr. A. H. Deekens, in Philaelphia, sixty-one.

The larger growths take years to develop. One woman carried her burden seventeen years.

A large tumor hanging between the thighs is apt to become ulcerated from ttrition, and an extensive hemorrhage may arise from such an area.

The chief distress comes from interference with walking or with the sexual unction, and in one case, from obstruction of the vaginal outlet during labor. Both of these difficulties existed in one of my own cases, in which a large lobular fatty tumor hung from the left groin close to the labium majus; nevertheless, the patient carried the growth thirteen years, until it alarmed her by becoming ulcerated.

The diagnosis rests upon the following factors: The tumor is well defined, void or round, softish, fluctuating or hard, generally pedunculate, often covred with wrinkled or lobulated skin; it is not reducible, is slightly hardened by the application of cold, and the septa may be faintly outlined on the surace; it is painless, unless ulcerated.

The treatment is extirpation; if the pedicle is long and thin, it may be imply constricted firmly, or slightly abraded and surrounded for ten minutes by a pledget of cotton wet with a saturated solution of cocain, and then cut ff at a distance of 1 or 2 cm. (⅖ to ⅘ inch) from its attachment. The growth is ften supplied by a single artery in the center, which should be tied with catgut. The wound is closed by catgut sutures, and the dressing applied. Where there s not a well-defined pedicle, one may often be formed by grasping the tumor nd drawing it out from the body. The incision must here be made well out rom the body on the under side of the tumor, otherwise there will be a large efect in the skin when the tumor is taken away. There is no objection to utilizing a part of the skin covering of the growth in this way, as it is in all espects normal, and there is no danger of the tumor recurring.

Large sessile growths extending up into the inguinal canal, or into the vagina, or out on to the perineum, must be removed by making an oval incision through the skin over the growth, and shelling out the fatty mass, ligating bleeding vessels, and then approximating the skin with sutures. Injections with alcohol, removal by burning through the pedicle with the cautery, or ligation of the pedicle, leaving it to slough off, as practiced in the past, ought to be abandoned.

Hydrocele is an affection of the persistent canal of Nuck, characterized by an accumulation of fluid within it; it is exceedingly rare, owing to the fact that the canal is normally completely obliterated in the adult.

The hydrocele presents the appearance of a rounded elongate or moniliform cord extending like a string of beans from the region of the external inguinal ring down into the labium majus.

When the distended sac shows the constrictions, they appear in a succession of little swellings; at other times there is only a single elastic enlargement at the upper and outer angle of the vulva.

The diagnosis is established by noting the location of the affection, its direction upward toward the inguinal canal, and the fact that it does not give rise to any characteristic symptoms.

If the canal is patulous above, the fluid may be forced back into the abdomen.

The absence of any intestine from the canal may be ascertained both by percussion and by placing a finger over the ring and partially closing it, while the fluid is forced back into the abdomen by pressure made upon the tumor with the other hand; the sensation communicated is that peculiar to fluids alone.

When a hydrocele can not be differentiated from a small solid tumor in the canal, the use of the aspirator will determine the diagnosis in a simple and safe way.

Encysted hydrocele should first be treated by aspiration, after cleansing and shaving the part immediately over the swelling; if the tumor returns, the sac should be exposed and dissected out of the labium, all hemorrhage stopped, and the wound closed with catgut.

A sort of false hydrocele of the upper part of the canal is often associated with the presence of a large amount of ascitic fluid in the abdomen, and depends upon the increased intra-abdominal pressure as its cause. The treatment then is that of the intra-abdominal condition producing the ascites, after which an operation may be called for to close the neck of the sac at the inguinal ring to prevent the occurrence of an inguino-labial hernia.

Inguino-labial Abscess.—I have found this condition in the left inguinal canal of a mulatto; it occupied the upper outer part of the labium, and was about 3 cm. in length by 2.5 cm. in width. The abscess was hard but slightly irregular, movable, very painful on pressure, and associated with a rise of temperature.

After due preparation an oval incision was made over the enlargement and the entire honeycombed abscess was enucleated from the inguinal canal down to the pubic ramus, which was laid bare. The chief difficulty in the extirpation arose from the extreme vascularity of all the surrounding adherent tissues. Hemorrhage was controlled by numerous ligatures passed deeply under the tissues and tied tight. A thin strip of iodoform gauze made an efficient drain for such oozing as could not be checked immediately. This was removed in two days, and the wound healed throughout; the skin sutures were removed in a week.

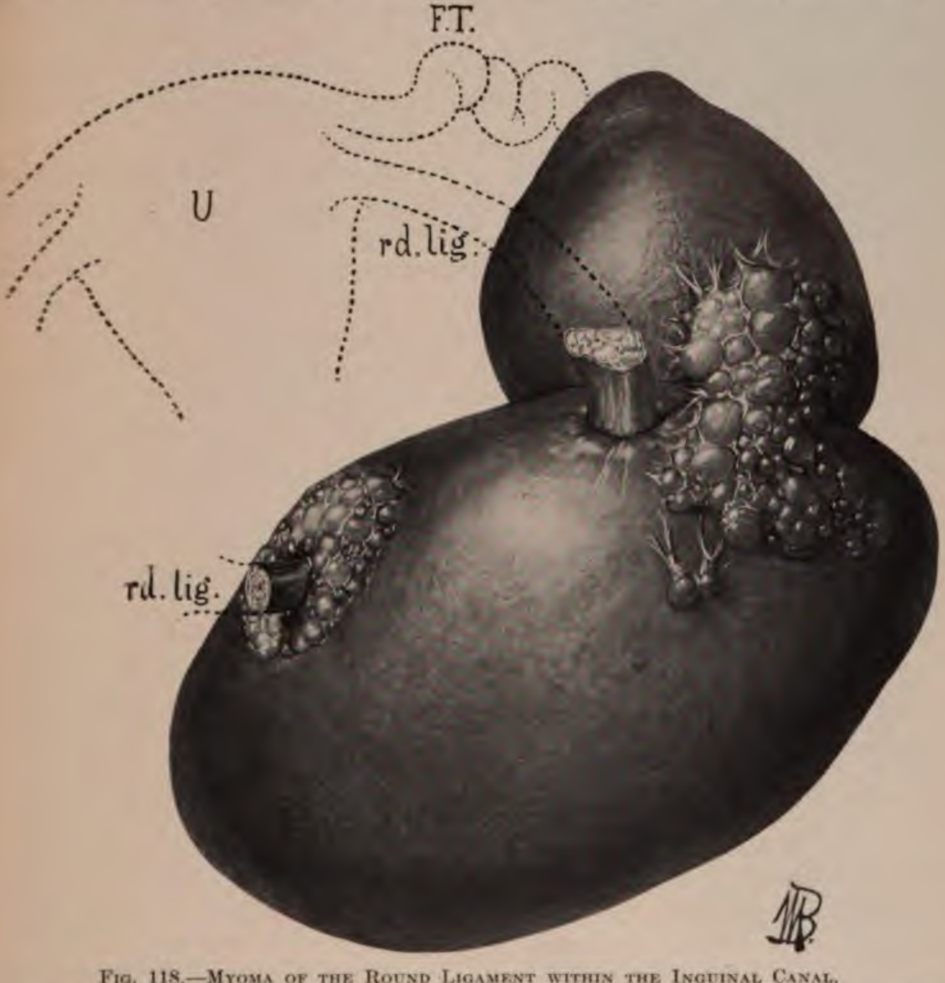


FIG. 118.—MYOMA OF THE ROUND LIGAMENT WITHIN THE INGUINAL CANAL.

The tumor consists of two masses, of which the upper has pushed its way down into the pelvis behind the peritoneum, while the large mass filled the canal. The diagram shows its relations to the left round ligament; the little lobulated masses at each end are fat. OCT. 12, 1893. Natural size.

Pseudo-myxoma of the Canal of Nuck.—I have observed this condition in a case of pseudo-myxoma of the peritoneum due to a ruptured ovarian cyst, in which the encysted mass below the inguinal canal was about 3 by 2 cm., and shut off from the peritoneal cavity. The vermiform appendix was glassy in appearance and distended with the myxomatous material to three or four times its normal diameter.

Hernia appears in the form of hernia inguino-labialis. The hernial sac forms a pouchlike prolongation of the abdominal parietal peritoneum, and extends down into the labium majus, which may be greatly enlarged, displacing the vulvar orifice to the opposite side.

The sac presents a distinct swelling from its exit at the inguinal ring above down to its lower margin beside the vaginal outlet, and contains omentum, or omentum and serum, or omentum and intestines.

The diagnosis is readily made upon observing that the tumor extends up into the abdomen, and that it is tympanitic, gurgles on pressure, and can be replaced by putting the patient on her back with elevated chest and flexed thighs in a position of relaxation; on standing and straining it descends again into the labium.

Tumors dull on percussion and irreplaceable are formed by a part of the omentum adhering to the neck of the sac, together with serous fluid transuded and incarcerated in the sac. The use of the fine needle of the aspirator will here settle the doubt. For description of the operation, see Chapter XLI, Vol. II.

Fibroma and Myoma of the Round Ligament.—The most common new growths of the round ligament are fibroma and myoma. Both of these tumors appear as small unilateral growths which gradually enlarge, giving, however, little or no pain.

The differential diagnosis between fibrous tumors of the round ligament and other affections of the inguinal canal is not difficult, depending upon the location, fixation, hardness, and painless character of the growth.

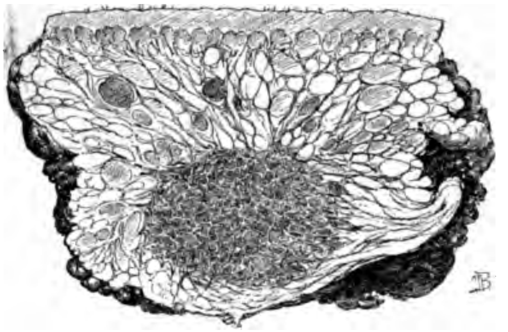


FIG. 119.—ADENO-MYOMA OF THE ROUND LIGAMENT.

Natural size in longitudinal section. The skin is above; beneath the skin is a coarsely reticulated fat with septa radiating from the adeno-myoma in the lower half of the specimen, and surrounding it. Several dark areas of hemorrhagic infarct seen in the fat.

The following case of fibroma of the round ligament presented a typical history (C. H., October 13, 1893, Path. No. 65). The patient first noticed a small mass the size of a pea in the inguinal canal above the spine of the pubes, which grew gradually and never gave rise to any pain. On entering the hospital the tumor was about the size of an egg, slightly movable, painless on pressure, and irreducible.

The operation consisted in an incision along the course of the canal, exposure and ligation of the round ligament at the points of entrance and exit from the tumor, removal of the tumor, and closure of the canal.

Pathological Report.—Tumor, 8 by 6 by 5 cm., ovoid in shape, with a smaller mass springing from one side. The surface of the tumor is shaggy and in places masses of adipose tissue are seen. At the junction of the larger and the smaller mass is a cord, 5 mm. in diameter, which runs directly into the mass. On section its fibers merge into those of the tumor. The tumor is dense, elastic on section, and of a uniform grayish color.

Microscopical examination: Tumor consists of fibrous tissues rich in nuclei; the fibers are more or less concentrically arranged around a central portion, which consists of non-striated muscle fibers with bands of fibrous tissue running between the striæ. This center is definitely outlined from the surrounding fibrous tissues and is evidently the round ligament. The specimen shows everywhere groups of small canals lined by one layer of cells; these are probably lymph spaces. The specimen is poor in blood vessels.

Diagnosis: Fibroma of round ligament.

I have operated upon one case of adeno-myoma of the round ligament, one of the rarest of the tumors of this region. The growth is benign, and its clinical features in no way differ from fibroma. The tumor possesses considerable pathological interest conforming to the type described in Chapter XXXVI, Vol. II, under the title of adenomyoma of the uterus.

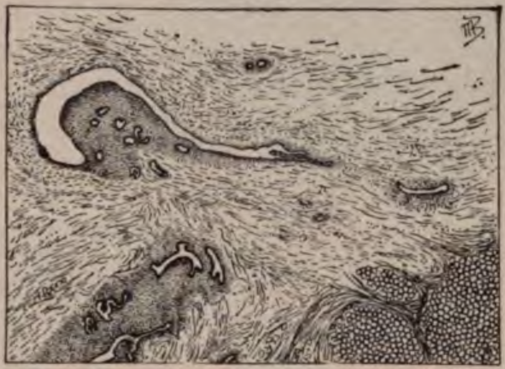


FIG. 120.—A PORTION OF THE ADENO-MYOMA, 12 TIMES MAGNIFIED.

The specimen consists chiefly of non-striped muscle fibers. In the right lower corner are masses of fat cells. In the vicinity of the left upper corner is a pseudo-glomerulus, composed of stroma, scattered throughout which are cross sections of several glands. The surface of the glomerulus is covered by one layer of cylindrical epithelium, and its capsule is composed of one layer of cells which in places are cuboidal or almost flat. The cells of the capsule have practically no underlying stroma, but lie directly on the muscle fibers. The space between the pseudo-glomerulus and the capsule, on tracing it to the right, is seen to be continuous with a gland cavity, and is nothing more than a dilated portion of the gland. Above and to the right of the pseudo-glomerulus are cross sections of two glands; below it are several longitudinal sections, one showing dichotomous branching. All of the glands are surrounded by stroma, which separates them from the muscle.

Condyloma.—Small condylomata are common in connection with gonorrhea. I have seen but one case of extensive condylomata, which occurred in the practice of Dr. B. F. Baer, of Philadelphia. These were as large as a man's fist and situated upon the lower left labium majus. The patient was pregnant at the time, and the tumor hung from the vulva attached by a broad base to the sound skin, presenting a typical vegetating warty appearance, and continually moistened with secretions.

The operation was by excision with the cautery knife. The better plan, according to present methods, is by excision with the scalpel and suture.

Carcinoma.—Carcinoma of the external genitals is commonest between the ages of forty-five and sixty. The disease is recognized in its earlier stages as a well-defined, hard, nodular mass, with everted margins, infiltrating the skin, and broken down and ulcerating in the flattened central portion. In the more advanced stages the numerous secondary nodules with the brawny skin and enlarged inguinal lymphatics can not be mistaken.

The tendency of the disease is to extend continuously up to the vaginal outlet but not beyond it, and then across to the opposite side, or down over the perineum; if not checked, the growth always extends up into the groin. When the inguinal glands are infected, the labium also presents a choked, irregular, knotted appearance, with ulceration in the older portions of the disease. There

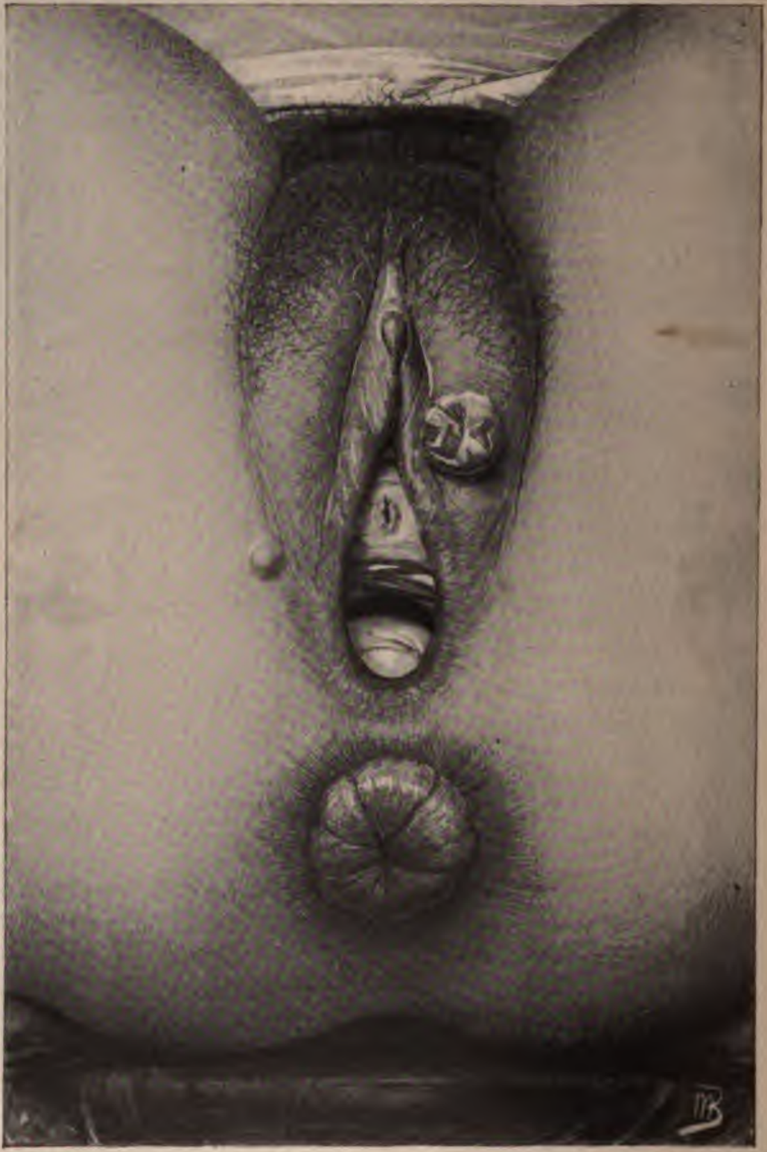


FIG. 121.—EARLY EPITHELIOMA OF THE LEFT LABIUM MAJUS, FORMING A HARD PROJECTING NODULE, FLAT ON TOP, COVERED WITH A THIN EPITHELIUM AND ERODED IN SPOTS.

No return two years after removal. The vaginal outlet is relaxed, there is a fibroma on the right side at the lower angle of the labium, and there are extensive external hemorrhoids. Path. No. 442.

is always, in spite of these changes, a marked tendency to preserve the general contour of the labium, giving the cancerous mass a pyramidal form, with its base above. Its wet fissured surface secretes a fetid, watery fluid, and foci of suppuration are not uncommon.

In one case, in which the disease lay partly on the mucous surface, the corresponding surface on the opposite side had a thick, white, macerated appearance, but did not appear to be affected with the disease. After a thorough extirpation of the right labium, the woman returned fifteen months later for operation upon an extensive involvement of the left labium. There was a brawny induration of the labium above the disease with deep pigmentation of the surrounding skin; the infiltrated skin bordering on the tumor was of a dark-violet color, separated from the more prominent ulcerating mass by a sulcus.

The earliest case I have seen (Mrs. J. B. R., No. 3013, September 8, 1894), if I except the contact inoculation above mentioned, was a diseased area 2.5 cm. (1 inch) in diameter, smooth, hard, white and bright red in places, circular, slightly elevated, painless, and situated on the lower part of the left labium (see Fig. 121). This was removed by a wide, deep excision, and in three years there had been no evidence of a recurrence. The microscopic examination showed that it was an epithelioma.

The patient with carcinoma complains of itching and burning, with shooting and stabbing pains. Bleeding is not a prominent symptom.

Excision is the proper treatment. The use of the cautery or destruction with caustic is no longer admissible. The operation should be performed under continuous irrigation. It is important to give the disease a wide berth by making the incision around it at least 2 cm. (1 inch) distant on all sides, except the vaginal. It is not necessary to carry the incision inside the vagina, unless the disease extends up to the hymen. The whole labium is usually excised with as much of the surrounding skin as is necessary. In all cases the inguinal glands of the side on which the disease occurs must also be dissected out unless there is an extensive infiltration of these glands, which forms a contraindication to any operative interference.

To remove the cancerous growth the oval incision around it is carried through the skin, after which the mass is covered with iodoform gauze, grasped, and drawn out from the body, while the scalpel cuts beneath it and rapidly dissects off the entire labium with its underlying fat down to the deep fascia. Two or three arteries, large enough to be troublesome, may need clamping, and afterwards a fine ligature. It is best to free the inner side first by dissecting from within outward, to avoid buttonholing the mucous surface, which one is liable to do in dissecting in the opposite direction.

The large defect left by the removal is covered by drawing the outer margin to the inner with deep interrupted catgut sutures, making the line of union in the long axis of the labium removed; the skin is united with subcuticular catgut sutures, or interrupted silkworm gut with catgut between.

Where much tissue has been removed, the tension of bringing the edges of the wound together will distort the neighboring soft parts and drag the urethra toward the affected side. This distortion will necessitate careful attention in keeping the parts clean and dry during the convalescence, because the patient will not be able to urinate without wetting the wound. In such a case I leave a soft catheter in the bladder for the first forty-eight hours, and after that require the patient to be catheterized three times a day by a careful nurse, who has had pointed out to her the new position of the orifice and the altered direction of the urethral canal.

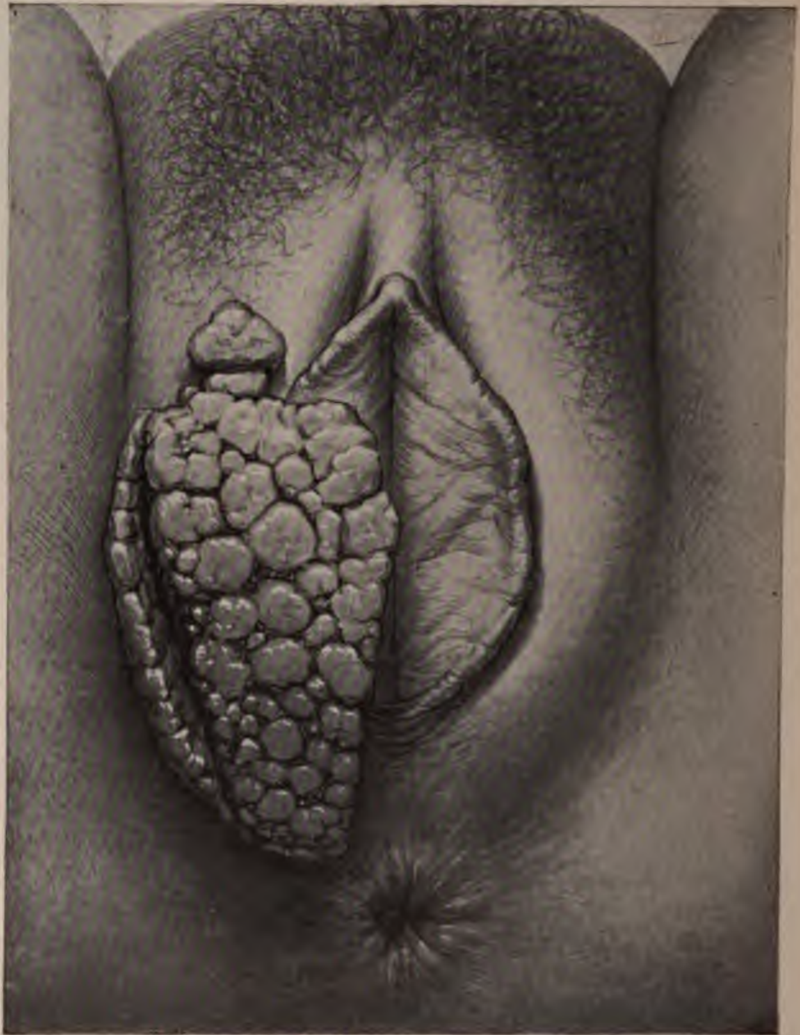


FIG. 122.—ADVANCED EPITHELIOMA OF THE RIGHT LABIUM MAJUS.

LABIA MINORA.

Diseases affecting the labia minora alone are rare. These structures are more liable to be involved in processes starting in and implicating the neighboring organs at the same time; thus they are affected in carcinoma of the external genitals, in elephantiasis, and in pruritus. In these conditions, and in inflammation, the labia do not appear as distinct organs, but merely as coarse reduplications on the mucous surfaces of the labia majora.

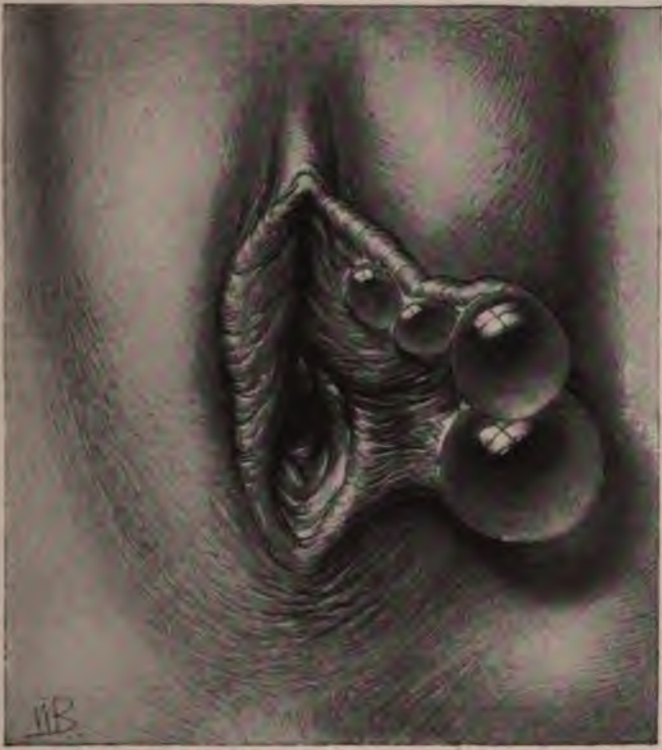


FIG. 123.—CYSTS OF LEFT LABIUM MINUS. OCT. 17, 1893.

In my private practice I have had one case of multiple cysts of the labia minora from ½ to 2 cm. in diameter (Fig. 123).

Small sebaceous cysts are sometimes met with, occasioning a slight irritation and necessitating an incision to evacuate the contents.

I have had occasion once to remove a small lenticular inflammatory mass from the upper part of the right nympha, brought about by the contusion of a bicycle seat (see Fig. 124). The little flat nodule, which occasioned the patient much discomfort, was excised under cocaine. The microscopic examination showed (Path. No. 1776) that it was small and firm, 1.6 by 0.8 cm. in size, and covered on its free surface by smooth skin. The center of the nodule was occupied by an inflammatory focus consisting of a dense mass of polymorpho-nuclear leucocytes, giving place toward the periphery to strands of swollen connective-tissue cells and young blood vessels. The skin covering was unaltered beyond a moderate leucocytic invasion.

I also removed on one occasion a small fibroma of the labium minus (Path. No. 1470) which occasioned no symptoms at all. The tumor, a round hard nodule, 8 mm. in diameter, was excised from the right labium minus, nearly in the median line, where it joins its fellow.

Histologically the surface was found to consist of several layers of stratified epithelium; the stroma was made up of a loose fibrillated tissue, consisting of spindle cells with spindle-shaped and oval nuclei. The protoplasm took but a faint nuclear stain. The superficial portion of the nodule was infiltrated with small round cells and a few polymorpho-nuclear leucocytes.

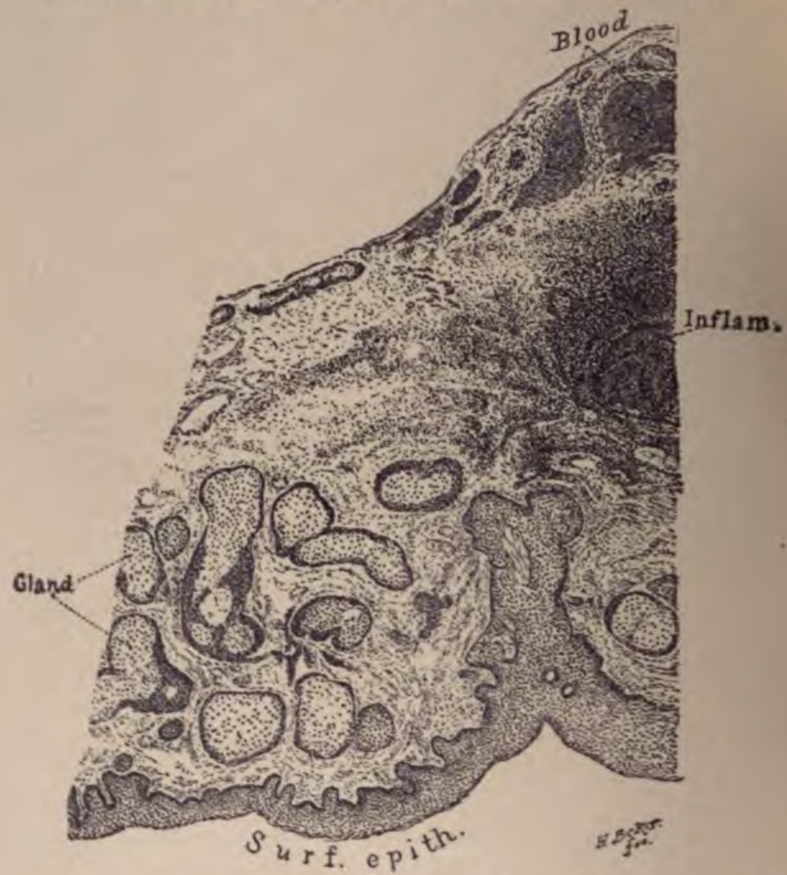


FIG. 124.—SECTION THROUGH SMALL ABSCESS OF THE LABIUM MINUS FOLLOWING A BICYCLE TRAUMA.

The treatment of growths of the labia minora is simple, consisting in the excision of the affected labium or such portion of it as is involved in the disease, followed by interrupted or continuous subcutaneous catgut sutures.

CLITORIS.

With a single exception, diseases affecting the clitoris alone are exceedingly . In elephantiasis of the external genitals the clitoris is prone to be organ most extensively involved.

Adhesions and Concretions.—The commonest affection of the clitoris is adhe- s between the glans and the hood covering it. These adhesions are almost ersally found, and never give rise to trouble unless an accumulation of ined smegma causes increased vascularity and irritation. In children these ges are apt to be followed by constant handling and friction.

In any irritation or ill-defined discomfort, manifested by a tendency to dle or rub the genitals, the clitoris should always be carefully inspected. s rule is the more stringent in the case of little girls, who can not locate source of the discomfort (see Fig. 125).

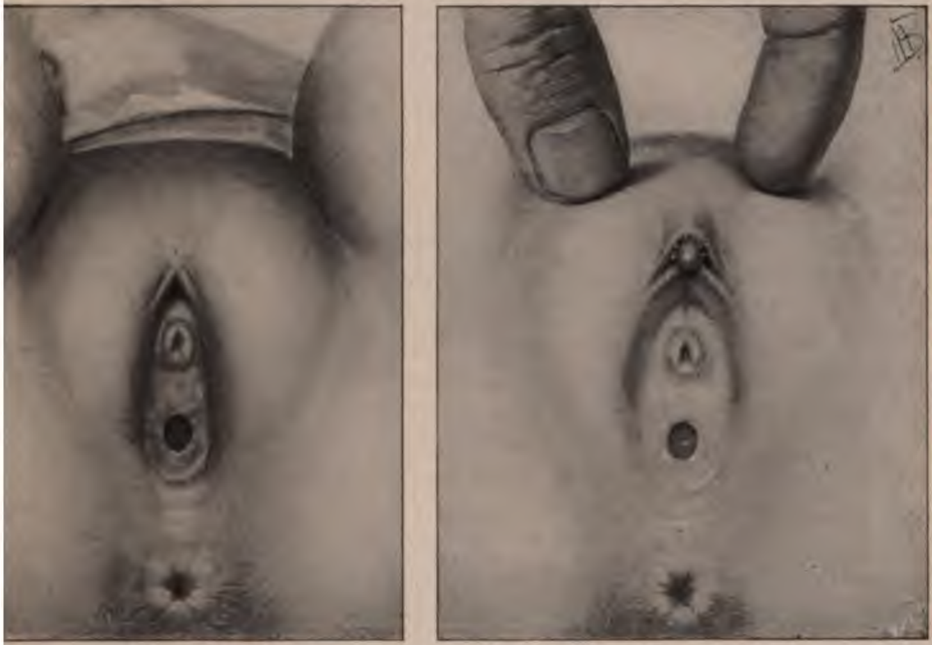


Fig. 125.—Preputial Adhesions in a Child One Year Old.

n the first picture the glans is completely covered in by the adherent prepuce and the diminutive minora. In the second picture the adhesions have been severed and the glans is exposed, encircled ttle accumulations of smegma.

An inspection of the glans of the clitoris should form a part of every gyne- gical examination which proceeds in a routine manner to investigate the dition of the sexual organs.

The glans is exposed by grasping the fold of mucous membrane covering it ween the thumb and forefinger and drawing it upward, at the same time hing in toward the symphysis and causing the glans to become extruded.

The adhesions will usually at once be seen in semicircular form on the convex surface of the glans back in advance of the corona.

The largest concretion I have seen, I removed from the dorsal surface of the clitoris of an unmarried woman of twenty-five, who was hysterical and showed signs of mental aberration (see Fig. 126). The mass was 1 by 1.2 cm., and beveled off at its discolored anterior extremity, which could be seen projecting from under the prepuce over the glans. The concealed portion was perfectly white. After releasing a few adhesions at the sides below it was easily lifted out of its bed.

FIG. 126.—CONCRETION REMOVED FROM BENEATH THE PREPUCE OF THE CLITORIS.

The shaded part was exposed and stained dark. Natural size. Path. No. 183.

The adhesions exposed by drawing back the prepuce should be freed with a small, blunt probe. If the patient is not too nervous the anesthetic action of a strong solution of cocain (20 per cent) applied for ten minutes will be sufficient to benumb the sensibility. The exposed adherent surface, although denuded of its epithelium, bleeds but slightly. Here and there little white concretions of smegma, varying in size from a mere point to a mass a centimeter in diameter, come into view, as the adhesions yield to the strokes of the probe point.

The corona as well as the whole convex surface must be freed. The separation is completed when the sulcus back of the corona is exposed. The raw surfaces are now covered with vaseline. The patient should lie abed as long as walking produces discomfort.

The prepuce should be fully drawn back every day for two weeks and vaseline applied to prevent the adhesions from forming again.

This is best done with a little narrow spoon which I have devised for this purpose. The bowl of the spoon is filled with vaseline, and then placed under the prepuce, pushed gently up and turned from side to side, keeping the concavity over the glans which fits in it.

Elephantiasis.—Elephantiasis is a name given to an affection which must not be confounded with the elephantiasis of tropical countries, a parasitic disease affecting principally the lower extremities; this affection is rarely seen in this latitude, while elephantiasis of the genitals is by no means rare.

The resemblance between the two diseases is superficial only; in both, the organs affected exhibit a coarse hypertrophy with brawny induration.

The negro race seems to be peculiarly susceptible to this affection; all but one of the cases I have seen have been negresses.

The organs affected, in order of susceptibility are, the clitoris, the labia minora, and then the labia majora. The perineum may be involved, but beyond this the disease does not invade surrounding tissues.

My own observations lead me to conclude that the affection owes its origin to a chronic inflammation, associated with an obstruction of the lymph channels draining the external genitals. Syphilis is one of the commonest exciting causes.

I have seen eight well-defined cases, and in most of them areas of ulceration were to be found about the vulva with cicatrices in the inguinal region.

The enlargement may be more or less symmetrical when the clitoris is the chief organ involved, but when a labium majus is greatly enlarged, its fellow is usually but slightly, or not at all affected. One or both labia minora may be affected.

The disease is of rapid growth, enlarging to a mass the size of the fist in the course of one or two years. It is usually attended with severe pain in the genitals, often worse at night. Cramps are also felt in the legs. One patient was bedridden on account of her sufferings. Another who was under observation, desired the removal of hypertrophied right nympha on account of the pain. Syphilis as a rule will account for cases associated with headache and nocturnal pain.

Painful micturition and even incontinence are common symptoms, due to areas of ulceration and the involvement of the urethra. Leucorrhea almost always exists, and is often profuse.

The diagnosis is not difficult. Elephantiasis is distinguished from the other tumors by not possessing such sharply defined limits of growth. Close investigation always shows it to be a more or less grotesque hypertrophy of normal structures. The brawny feeling and the lobulated fissured surfaces are also important clinical characteristics.

Elephantiasis of the Clitoris.—A good illustration of the disease was afforded by the following case: The patient was a poorly nourished negress, thirty-one years old. Her menstruation, at first regular and moderate, had become irregular and profuse, and she had a constant, free, leucorrheal discharge. She complained of pains in the small of the back and in the abdomen, as well as of cramps in the legs, together with frequent painful urination, worse at night.

Upon examining her I found the vulvar cleft occupied by a large, pendulous, irregular tumor mass, attached at the anterior commissure and hanging down over the vaginal outlet. The vaginal outlet beneath this was found relaxed, the cervix stellately torn, and the uterus reclining in the sacral hollow. The tumor was shown by its relations to be an enormous clitoris, 10 cm. long, 5 cm. broad, and 4.5 cm. (4 by 2 by 1¾ inches) in antero-posterior thickness. Its lower rounded end was free and slightly notched beneath, having exactly the form of a large penis with a retracted prepuce. Back of the corona was a well-defined sulcus. Thickened preputial folds encircled the glans. At the sides lay the enlarged nymphæ. The growth had a broad base of attachment at the symphysis. The urethra lay intact beneath the clitoris, but the vaginal outlet was thickened and corrugated, and showed several superficial areas of ulceration from ½ to 1 cm. in breadth. A fetid leucorrheal discharge issued from the vagina. On the dorsal surface of the tumor was an irregular white patch 2 by 1 cm. (⅘ by ⅖ inch), probably representing an old area of ulceration in marked contrast to the surrounding deeply pigmented structures. Two little pedunculate tumors, the size of a pea and a hazelnut respectively, hung f the junction of the right nympha with the clitoris. Scars in the left groin in the supraclavicular region were evidences of old syphilitic disease.

The following case presents a picture of the disease when limited to the la minora: The patient was twenty-eight years old, and had passed through th

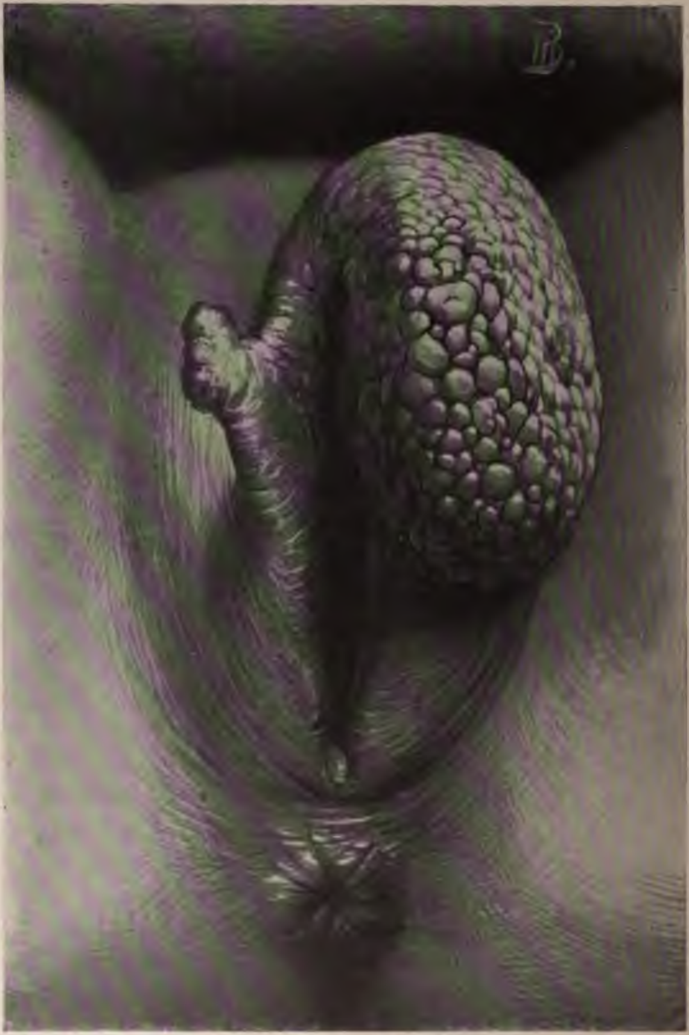


FIG. 127.—ELEPHANTIASIS OF LABIA MINORA; GREAT HYPERTROPHY OF THE LEFT SIDE

childbirths, all instrumental, the last premature at six and a half months, years before. She had lived a loose life, separated from her husband, and contracted an ulcer upon the external genitals two years before; upon e nation I found a cicatrix 1 by 1 cm., just within the posterior commi The urethral orifice was ulcerated and an ulcer lay on the anterior vaginal The labia minora appeared as a lobulated tumor 9 cm. long by 3 cm. broa by 1¼ inches), projecting 4 cm. (1½ inches) beyond the normal labia majora, and below the clitoris. There was a deep sulcus between each labium and the frenulum of the clitoris. The outer surfaces of the labia were divided by shallow sulci, the inner surface being smooth and glistening (see Fig. 127).

The treatment of elephantiasis is by excision. Where syphilis is evident and still active, antisyphilitic treatment should be started at once, and by frequent bathing and enveloping the parts in boric acid solution, vaginal douches, and touching ulcerated patches with a five per cent nitrate of silver solution, the parts are brought into a suitable condition for operation.

After placing the patient under anesthesia and suitably exposing the genitals, the hypertrophied mass is enveloped in iodoform gauze, or gauze saturated with a bichloride solution, grasped with the left hand and drawn out from the body, in order to form a distinct pedicle where none exists naturally.

An incision is now made into the pedicle just above its base, enough tissue being left to make flaps which can be easily brought together to cover the wound area. There is no danger of a recurrence of the disease from leaving a portion of the pedicle behind in this way.

A better plan, however, is to amputate from above downward. If the bleeding is excessive, vessels may be clamped, or, better still, the wound surfaces may be immediately drawn together by deep silkworm gut sutures, closing the upper portion of the wound and stopping the flow. The amputation is then continued on down, more sutures are applied, and so on until the whole mass is removed, and the wound completely closed.

Where the clitoris is removed, it will usually be necessary to ligate a few large blood vessels, particularly those on the dorsum, with fine catgut. When clitoris and labia minora are removed together, the wound presents the appearance of an inverted Y (⅄); an inverted V-shaped wound (Λ) is left after removing both labia minora.

In the case shown in Fig. 127 I adopted a slightly different procedure by pulling out the mass to form a pedicle, the upper part of which was transfixed by three stout silk sutures, one below the other, and the corresponding part of the tumor severed from above downward, leaving a slightly cupped, raw surface. The three sutures were then tied, firmly enough to serve the double purpose of approximating the opposite edges of the incision, and controlling the hemorrhage. By a succession of similar steps, first introducing the sutures, then severing that part of the pedicle overlying them and then tying the sutures at once, the large tumor was quickly removed with trifling hemorrhage.

Sarcoma.—One instance of this rare disease has come under my notice. The patient, a Pole, twenty-six years old, came to my service in the dispensary of the Johns Hopkins Hospital, complaining of constant pain in the genitals, increased by coitus.

A tumor, 4¾ by 2½ cm. (1 by 2 inches) in size, was found overlying the descending pubic ramus in the position of the left crus of the clitoris. It was pointed at both ends, above and below, hard, movable on its base, and slightly lobulated.

A wide incision should always be made; in this case the mass was removed by Dr. H. Robb, under cocain anesthesia, by an incision in its long axis, splitting a fibrous capsule in which it lay. Excessive venous oozing followed the enucleation, and was controlled with difficulty by pressure and the application of tannin.

She was discharged from the hospital in a week with a small linear, non-suppurating wound, and has not been heard of since.

After hardening the specimen in Müller's fluid, sections were made showing two kinds of tissues, cells in groups or long rows, with a homogeneous substance between them. In some portions instead of cell groups there were single cells with long, irregular processes, communicating with each other, imbedded in the homogeneous material filling the interspaces. The cells in groups and rows were generally spindle-shaped, with long nuclei, some of which resembled closely non-striated muscular fibers. All the cell groups and bands communicated so as to make the homogeneous material appear as islets between them.

In some portions of the tumor the cell groups made up the greater parts of the tissue; but every gradation existed between the groups and the single cells. In other places the intercellular substance predominated, and there were only scattered nuclei in the homogeneous material, with but little cell substance around them. In sections made after freezing, the homogeneous material swelled up and became transparent on the addition of acetic acid; in the hardened sections, it was in places slightly granular, and stained faintly with eosin.

Blood vessels were few, and were always found in the homogeneous material into which their walls gradually passed.

In sections stained with picro-carmine, the long bundles of cells where the nuclei were longest stained bright yellow, like muscle fibers. Nothing like this could be discovered in other parts.

The examination thus showed that the tumor was a sarcoma whose homogeneous intercellular substance was formed by a myxoid degeneration of the tissue; it was therefore a myxo-sarcoma.

Carcinoma.—Cancerous disease of the clitoris is rare. Two cases only have come into my hands for treatment. The first was a married woman, E. McD., J. H. H. Gyn. No. 179, fifty years old, who had three children, the last twenty-three years back.

She had ceased to menstruate four years previously, and since that time had suffered from severe itching of the external genitals, for which she had received local treatment without relief.

Two months before, she had noticed a spot of what she took to be proud flesh in the cleft of the vulva anteriorly; this grew rapidly until it reached the size of the end of the thumb. It was not painful.

I found on the dorsum of the clitoris an enlarged hard area, 1 by 8 cm.

in size, the surface of which was pouting, sharply defined, granular, warty, hard, yellowish, and slightly reddened; it was not adherent to structures beneath. To the right of the glans was a small patch similar to the first, 3 mm. in diameter. The labia minora were contracted down to short, thick rudimen-

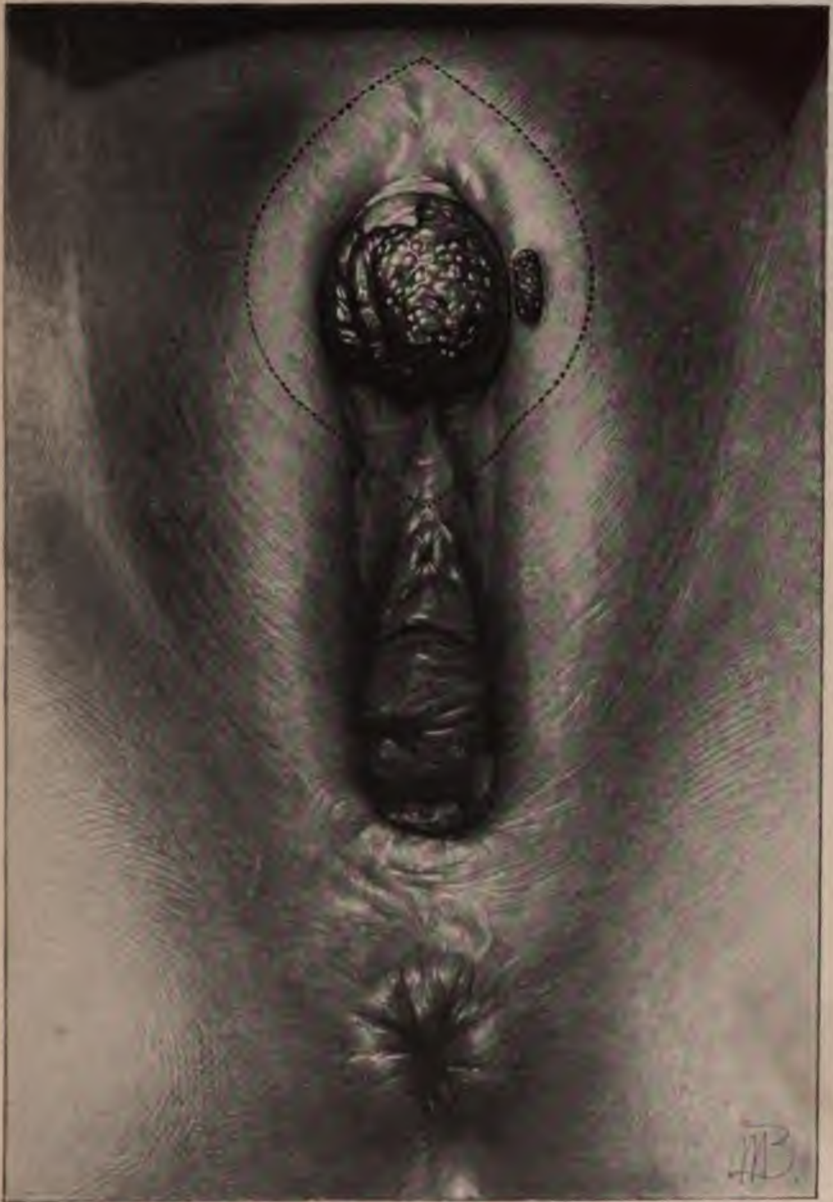


Fig. 128.—Carcinoma of the Glans of the Clitoris, with an Area of Implantation by Contact on the Left Labium Majus.

The dotted line indicates the area excised. Dec. 23, 1893.

tary folds. These, together with the white patches, bore evidence of the changes induced by pruritus and scratching.

She was operated upon April 22, 1890. The whole body of the clitoris down to the crura, with both labia minora, were excised, making a wound the shape of an arrowhead, whose edges were approximated by sutures passed transversely.

Twelve days later a recurrent nodule was found in the left labium majus, about 1 cm. from the scar. The whole upper portion of the scar and the adjacent tissue were excised down to the symphysis pubis and closed with six silkworm gut sutures. The wound healed, and there was no recurrence at a later date.

The second case (C. L., No. 2465, December 23, 1893) was thirty-eight years old, the mother of four children, the youngest seven years old; her mother died of cancer of the lip.

For eight years she had noticed a reddened area gradually extending between the labia anteriorly, and for the last six months growing rapidly. She had no pain in it until a few days before she came under observation; there was a mucoid discharge from the surface of the tumor.

I found upon examination a large, rose-red glans clitoridis, protruding anteriorly between the labia majora, 3 cm. (1¼ inches) long by 3.3 cm. (1½ inches) in breadth, ovoid in form, slightly indented on its under surface. On the convex surface, to the right, there was a pit 1.2 cm. deep by 1.8 cm. long, and on the right dorsum of the corona an irregular tongue of unaffected tissue 1.2 cm. by 0.3 to 0.8 cm. broad. There was an area of infiltration of the mucous surface of the left labium majus, 1 by 8 cm., where it lay in contact with the diseased glans (see Fig. 128).

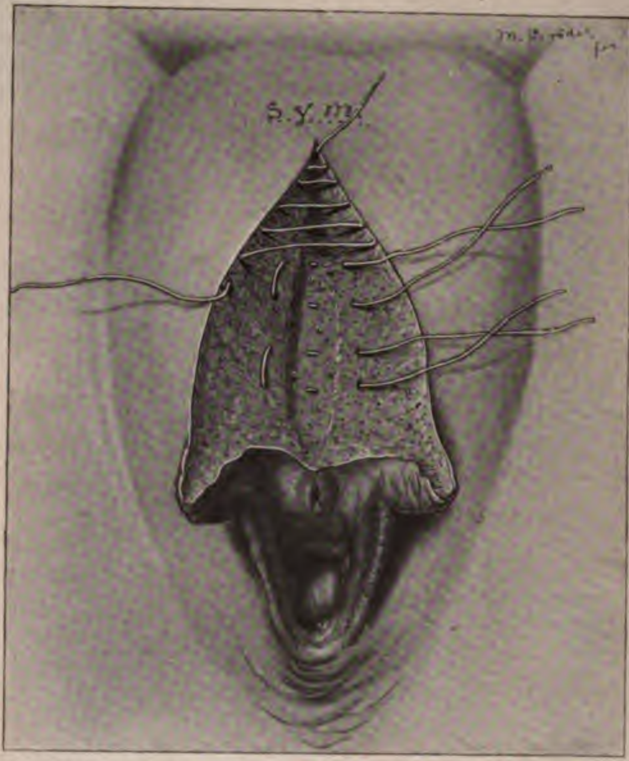


FIG. 129.—CLOSURE OF THE WOUND MADE BY EXCISION OF THE CLITORIS, BY MATTRASS SUTURES OF BURIED CATGUT AND SUBCUTICULAR CONTINUOUS SUTURE.

The vascular area in the deeper part of the wound is controlled by the mattrass sutures.

majora were deeply pigmented from scratching, and the labia
ithered, insignificant structures from old-standing pruritus.
was extirpated by an oval excision 12 by 8 cm. (5 by $3\frac{1}{2}$
ing from the mons veneris to the urethra.

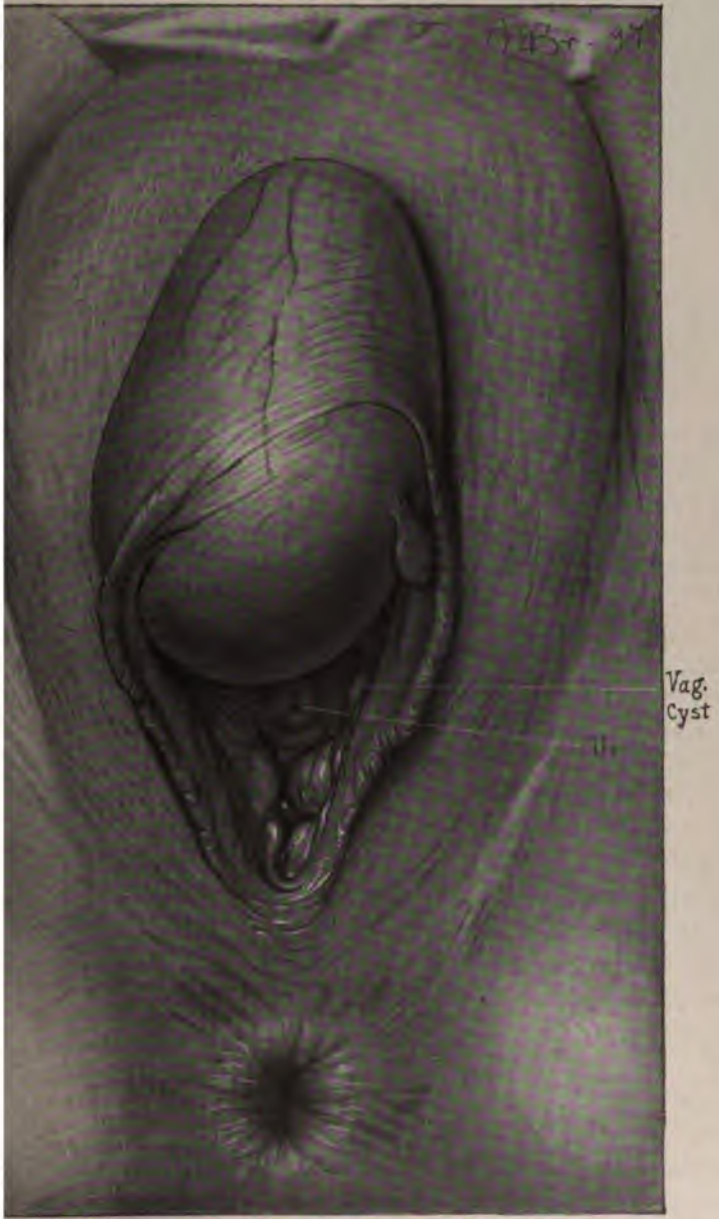


FIG. 130.—OVOID FLUCTUATING CYST OF THE CLITORIS.

ircles the convexity of the tumor, extending from one labium minus to the other,
ickle-shaped fold. The dorsal veins are shown above. A little lenticular vaginal
of the left labium minus. Oper. JUNE 21, 1897.

Numerous actively bleeding vessels were clamped, and six of them were ligated. The wound was closed by bringing the edges of the incision together from side to side by interrupted sutures. Primary union was secured, and the stitches removed on the seventh day.

The pathological examination showed that the specimen consisted of the clitoris with the surrounding skin and mucous membrane. The clitoris was converted into a mass 2½ by 2 cm., in whose center was an ulcerated cavity 1 cm. deep, with necrotic grayish edges; the remainder of the mass was firm, of a grayish-pink color, and circumscribed in its growth.

Microscopically the tumor was made up principally of squamous epithelial cells, in part arranged in nests, some of them forming the typical pearly bodies, and in part growing free in tissue. The stroma was fibrous tissue and existed only in small quantities. Everywhere there were numbers of lymphoid cells. The edges of the ulcerated cavity were necrotic, showing little inflammatory reaction. Great numbers of nerve fibers were found everywhere. The epithelial growth was completely circumscribed by fibroid tissue and seemed to have no tendency to invade the surrounding tissues. Beyond the growth was the normal mucous membrane, and beneath it the fat and fibrous tissue. The examination showed that the tumor was an epithelioma of the clitoris.

Cyst of the Clitoris.—I had occasion to remove (June 21, 1897) a large cystic clitoris, shown in Fig. 130. The following is the report of the pathological examination:

Mrs. S. C. (Path. No. 1795). The fluid is thick, sebaceous-like, and of a light brownish-yellow color. Microscopically it is found to contain numerous cholesterin and other irregular crystals. It also contains granular epithelial cells. On histological examination the outer surface of the cyst is seen to be covered by squamous epithelium; the walls are composed of wavy connective-tissue cells running mostly parallel to the surface. Near both the outer and inner surfaces are localized areas of small round cell and polymorpho-nuclear-cell infiltration. In one or two sections sebaceous glands can be seen. The inner surface of the cyst shows considerable variation in its epithelial lining, some portions being covered by three or four layers of squamous epithelium, the deepest layer of which is cuboidal, and others by one layer of cuboidal cells. In some portions where the epithelium is one layer in thickness the cells are columnar. The cyst has evidently arisen from the clitoris.

BARTHOLIN'S GLANDS.

Cysts of Bartholin's Glands.—Bartholin's gland, or as it is sometimes called the vulvo-vaginal gland, was named after Erasmus Bartholinus, who described it minutely in the seventeenth century. In 1761 Duverney gave in detail the results of its further study, and pointed out the resemblance between its tissue and that of the prostate; he also mentioned the existence of a duct and demonstrated its opening at the vulva ("Œuvres anatomiques," Paris, 1761, vol. ii, p. [illegible] Huguier, in 1850, published a thorough and extensive article on the

of this organ (" Mémoire sur les maladies des appareils sécréteurs des
génitaux externe de la femme." *Mém. de l'Acad.*, Paris, 1850, vol.
31). In 1892 Müller gave a *résumé* of the literature concerning the
nent of Bartholin's glands. He says they are first recognizable in the
hen it has attained a length of 4.5 cm., appearing as solid cords passing
the *sinus urogenitalis.*

tomy.—The glands are two in number and are situated in the para-
tissue. They are about the size of a pea. The duct passes down on
er or vaginal as-
d opens just be-
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Huguier, who
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he gland may oc-
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can be squeezed
m the duct as
in Fig. 131. In
2 the relation of
nd to the vagina
ly outlined; the gland has, however, been pushed away to the side by
developing in the duct. The glands in this particular case are rather
han usual.

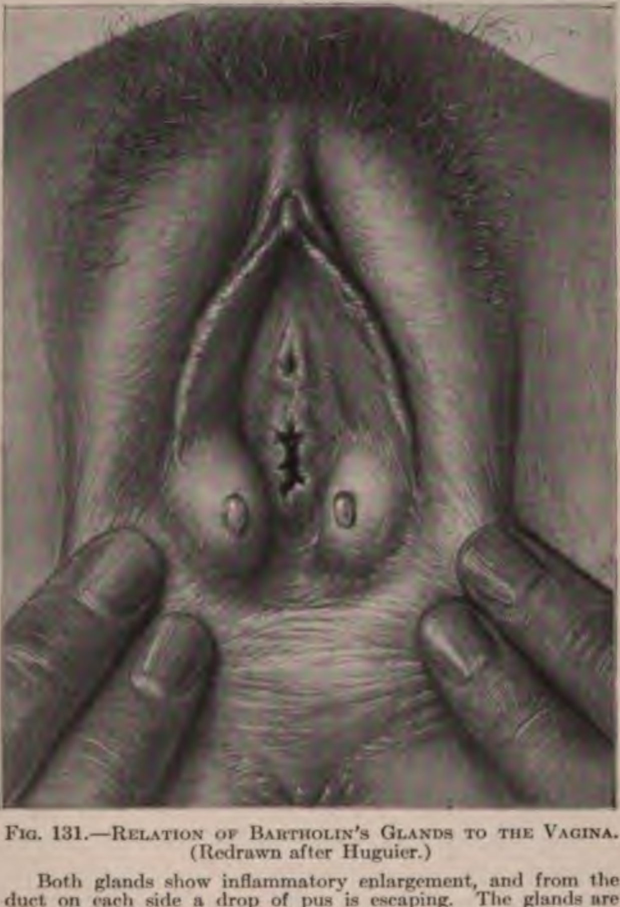


FIG. 131.—RELATION OF BARTHOLIN'S GLANDS TO THE VAGINA.
(Redrawn after Huguier.)

Both glands show inflammatory enlargement, and from the duct on each side a drop of pus is escaping. The glands are found in the lateral walls, a short distance above the fourchette (see T. S. Cullen, "Cysts of Bartholin's Glands," *Jour. Amer. Med. Assoc.*, JAN. 21, 1905).

er normal conditions the gland secretes a small amount of whitish,
tenacious fluid, closely resembling the white of an egg. The gland

function, according to Müller, is complete at the fifth or sixth month of intra-uterine life. The gland itself diminishes in size from the ninth to the twelfth year, it rapidly increases again between the sixteenth and eighteenth years, and in old age it undergoes atrophy.

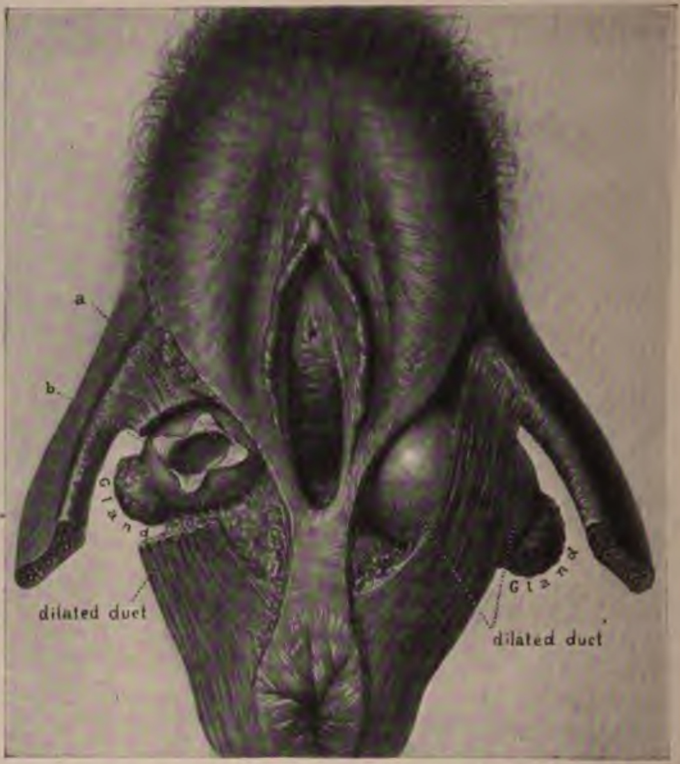


FIG. 132.—DEEP RELATIONS OF BARTHOLIN'S GLANDS TO THE VAGINA. (Redrawn after Huguier.)

In this case the duct to the right of the vagina has become considerably occluded and is cystic, forcing the gland, which is considerably enlarged, farther out than usual. On the left of the vagina the duct is markedly cystic. Ordinarily the glands lie in the adipose tissue just external to the vagina, partially covered by the muscle shown in the drawing (see T. S. Cullen, *ut supra*).

Histologic Appearances.—On carefully dissecting out the gland and examining it with a low power, it is found that the duct, after leaving the vagina, gradually decreases in diameter in the vicinity of the gland. It then divides into secondary ducts, and these in turn divide, forming terminal ducts, which drain the secretion from the lobules. The entire gland may be likened to a bunch of grapes, more developed on one side than the other. The main duct corresponds to the stem, the secondary and terminal ducts to the branches, and the lobules represent the individual grapes. Fig. 133 demonstrates very well the gland seen on section; *c* and *d* are cross or oblique sections of the secondary ducts, and *a* is a well-defined lobule.

The duct near the vagina is lined with many layers of squamous epithelium, as seen in the central portion of Fig. 134. As we pass toward the gland, the main duct lining is composed of transitional epithelium, still many layers in thickness. In the deeper layers the cells are squamous in type, but in the superficial layer—the one directly in contact with the lumen of the duct—they are of the high cylindrical type. The secondary ducts are likewise lined by transitional epithelium, but the number of layers is generally much less. The terminal ducts may be found lined with transitional epithelium, but I have usually found them covered by only a single layer of epithelium. Sometimes the cells are high cylindrical in type and in others cuboidal. The glands forming the lobules are tubular or slightly racemose; they are round or oval on cross section, and are lined by one layer of high cylindrical epithelium (see Fig. 134). The cells, if filled with mucus, may be goblet-shaped. The cell nuclei are small, round, or somewhat flattened, they stain deeply, and are situated at the base of the cell. They bear a striking resemblance to the cylindrical epithelium of the cervix. Their protoplasm, however, does not take a hematoxylin stain, as is so often noted in cervical epithelium. While these small glands which make up the bulk of Bartholin's glands are for the most part confined to the lobules, isolated specimens are found here and there, opening directly into the main duct, or into the secondary ducts as shown in Fig. 134 at *c*.

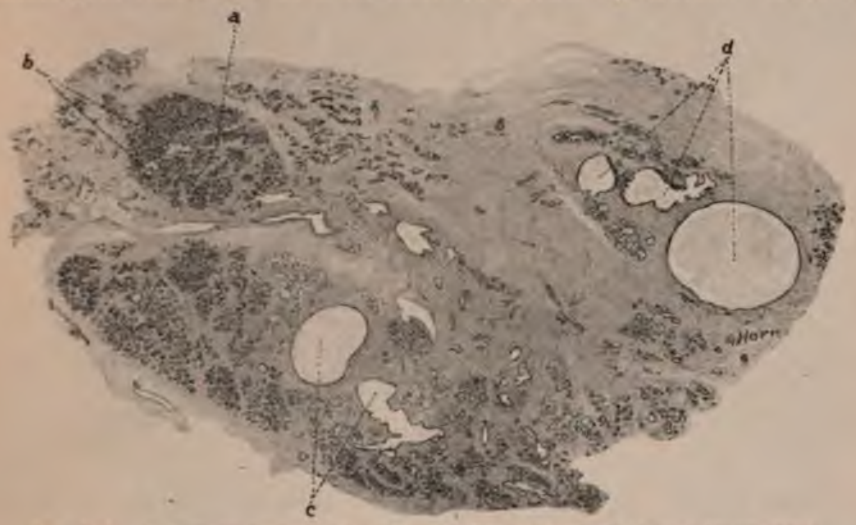


FIG. 133.—A SECTION THROUGH THE ENTIRE BARTHOLIN'S GLAND (9 DIAMETERS).

a gives a clear idea of a lobule composed of many small glands and partially separated by stroma from the neighboring gland elements. At *b* are sections of this lobule's terminal duct. At *c* and *d* are sections of larger ducts (see T. S. Cullen, *ut supra*).

The elements of Bartholin's glands are held together by a definite connective-tissue framework, rich in blood vessels and in non-striped muscle fibers. This tissue, according to Müller, is amply supplied with nerves.

Formation of Cysts.—From the observations of Müller, we learn that the duct of Bartholin's gland is about .5 mm. in diameter at its exit and that in the neighborhood of the gland its caliber may be fully 2 mm. It is readily seen that any irritation inducing a vaginitis might cause the two sides of this small duct to become glued together, and thus prevent the escape of the gland

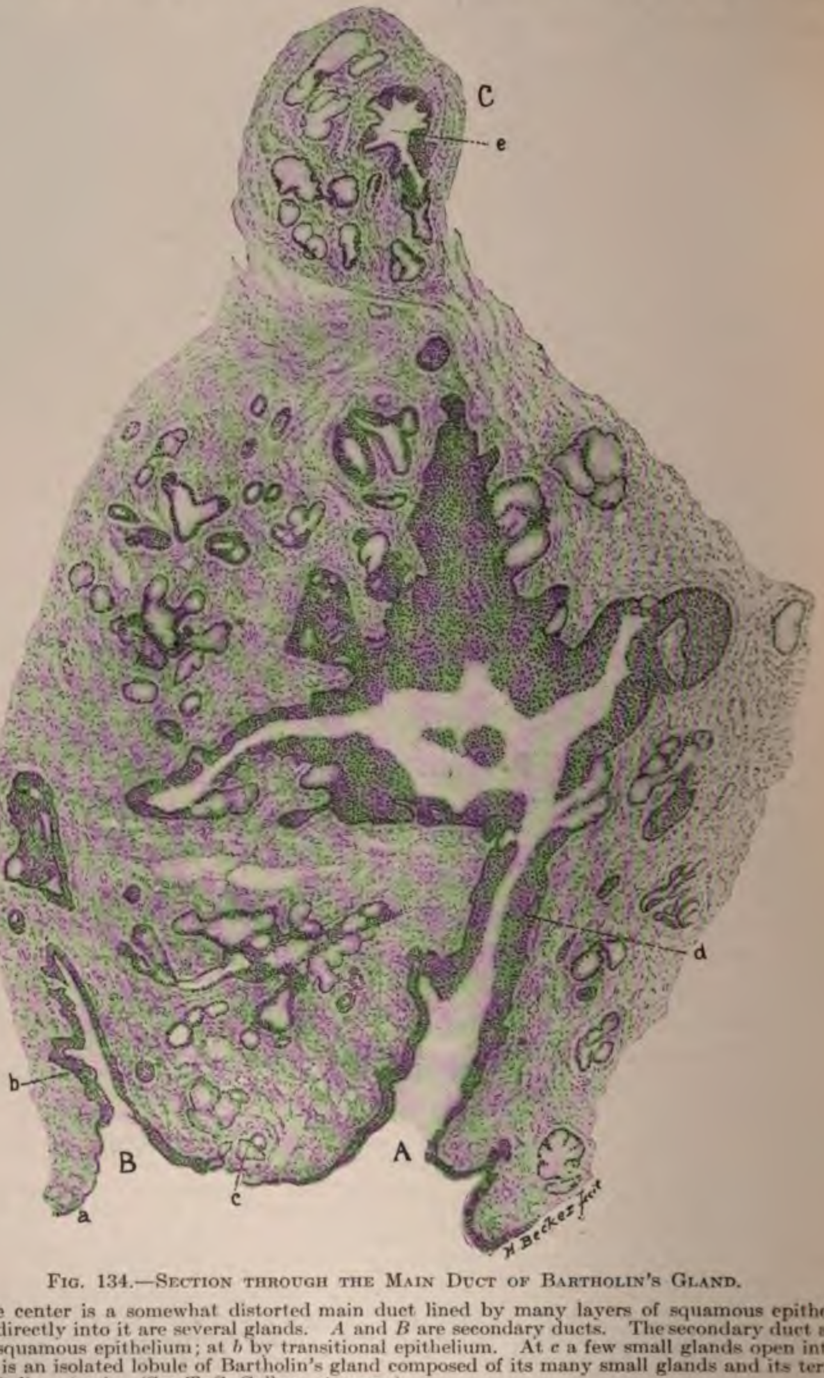


FIG. 134.—SECTION THROUGH THE MAIN DUCT OF BARTHOLIN'S GLAND.

In the center is a somewhat distorted main duct lined by many layers of squamous epithelium. Opening directly into it are several glands. *A* and *B* are secondary ducts. The secondary duct at *d* is lined by squamous epithelium; at *b* by transitional epithelium. At *c* a few small glands open into the duct. *C* is an isolated lobule of Bartholin's gland composed of its many small glands and its terminal duct *e* (33 diameters). (See T. S. Cullen, *ut supra*.)

contents. As a matter of fact this frequently occurs, especially if there is a gonorrheal infection. If the inflammation is of a virulent character an abscess of the gland is likely to follow, but if the infection is a mild one, there is simply a retention of the secretion and the subsequent development of a cyst. In some cases the secondary ducts are blocked, while the main duct remains patent. We then usually have multiple cysts in the substance of the gland.

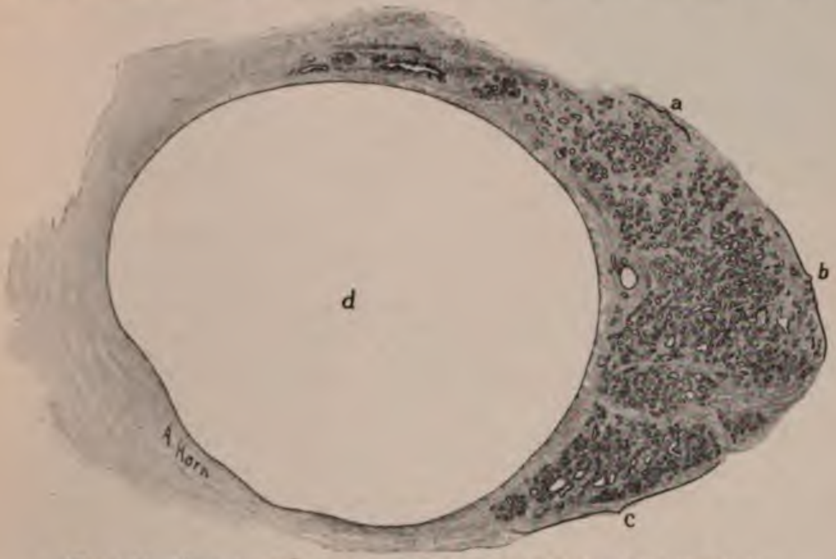


FIG. 135.—CYST OF THE DUCT OF BARTHOLIN'S GLAND (6 DIAMETERS).

The gland substance has been pushed to one side. The lobular arrangement of the gland is well shown by the three distinct lobules *a*, *b*, and *c* (see T. S. Cullen, *ut supra*).

Cysts Due to Occlusion of the Main Duct of Bartholin's Gland.—These cysts are superficial (see Fig. 132), and vary in diameter from 1 to 4 or 5 cm. The body of the gland is pushed outward into the surrounding adipose tissue, as shown in Fig. 135. The cysts may contain a clear limpid fluid, which is often viscid, but when hemorrhage has taken place from the cyst wall, it is yellowish or chocolate colored. The inner surface of the cyst is smooth, but here and there small round or sickle-shaped ducts open into the main duct (see Fig. 136). They have naturally become dilated, owing to the damming back of the secretion which can not escape. Sometimes the large secondary ducts become completely disconnected from the main duct, and they in turn give rise to secondary cysts.

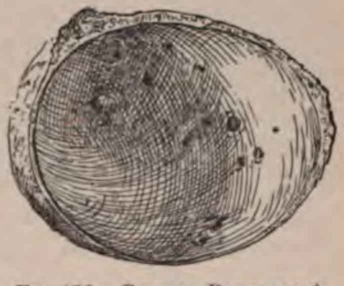


FIG. 136.—CYST OF BARTHOLIN'S GLAND. (NATURAL SIZE.)

The cyst is egg-shaped, has a smooth inner surface, and at numerous points shows dilated sickle-shaped or round openings of the secondary ducts. To the left is the substance of the gland (see T. S. Cullen, *ut supra*).

The character of the cyst lining will, of course, depend on the situation of the point of occlusion. If this is near the vagina, the cyst wall will be lined by a varying number of layers of squamous epithelium, while that portion of the cyst originating from the duct near the body of the gland will show a lining of transitional epithelium. At numerous points over the inner cyst surface the lining will consist of a single layer of cells, of the high cylindrical or cuboidal variety. This is due to the unfolding of the small glands that here and there open along the course of the duct.

Cysts Due to the Occlusion of the Secondary Ducts or of the Terminal Ducts.—These cysts are naturally much less common. They are multiple and very small; their contents are similar to those of the larger cysts. Their lining at certain points is composed of transitional epithelium and at other points of cylindrical cells.

Clinical History.—The patient usually gives a more or less definite history of an old inflammation of the vagina, followed, after an interval of weeks or months, by the development of a swelling low down in one or both vaginal walls. As a rule, this swelling is not very painful, but if it is bilateral, it is frequently associated with discomfort on locomotion. Not infrequently a patient will enter a hospital for a perineal operation, and a small cyst, which has never given the slightest trouble, will be detected.

Treatment.—The treatment is either by free incision into the lower portion of the cyst and evacuation of its contents, followed by an application of nitrate of silver solution and a pack in the cavity, or by total extirpation.

Incision and packing are the simpler of the two methods, but they do not invariably effect a cure. When this form of treatment is employed, an anesthetic need not, as a rule, be given. The vulva is shaved and both vulva and vagina cleansed; the tumor is then grasped and pressed forward from behind with the thumb and second finger reaching down from above and making it tense. A 10 per cent solution of cocain is applied for ten minutes. A narrow sharp-pointed knife is then quickly plunged through the skin surface into the cyst, which is split up for 3 or 4 cm. (an inch or more) as it is in the act of collapsing. The bleeding is never more than moderate. The inner surface of the collapsed cyst is now painted with a 10 or 20 per cent solution of nitrate of silver, and packed with a long, thin strip of iodoform gauze. It is well to leave the gauze in place until it is bathed in abundant suppuration, when it may be drawn out and a fresh piece laid within to keep the opening from closing until it is filled with granulations.

In making a complete extirpation of the gland three difficulties present themselves: First, to sever its close attachments to the deep cellular tissue under the pubic ramus; second, to control the free hemorrhage in the deeper parts; and third, to avoid perforating the thin septum on the mucous surface.

The enucleation is best conducted under continuous irrigation. An incision is made through the skin surface of the labium, over the whole length of the cyst down to its wall; with pressure on each side the incision is retracted, exposing the cyst, which is rapidly dissected free on all sides.[1] The dissection must be slowly and carefully made on its inner side to avoid cutting through the thin mucous surface. It is best not to rupture the cyst in enucleation, so as to prevent the escape of its contents over the wound, as well as to avoid the difficulty of finding and removing all parts of the cyst walls. After the more exposed part has been freed, the cyst must be gently drawn to one side and then to the other with the fingers, while the posterior surface is freed. The cyst must not be grasped with forceps for fear of rupturing it. The hemorrhage from numerous small vessels is controlled by the stream of water constantly running over the field. When the vulvo-vaginal duct is cut, the contents of the tumor often begin to exude by the fine orifice.

The removal of the cyst leaves a deep bleeding cavity in the labium. All persistently bleeding vessels are caught and tied with fine catgut. Neglect of this precaution will result in the formation of a blood tumor of considerable size; I have seen one such hematoma containing 90 cubic cm. (3 ounces) of blood, and the overflow into the patient's bed was estimated at an additional liter. The pulse, which had been normal, went up to 150. A profound anemia resulted. After checking the bleeding, interrupted silkworm gut or silk sutures are passed on the skin surface, the loop of each suture reaching to the bottom

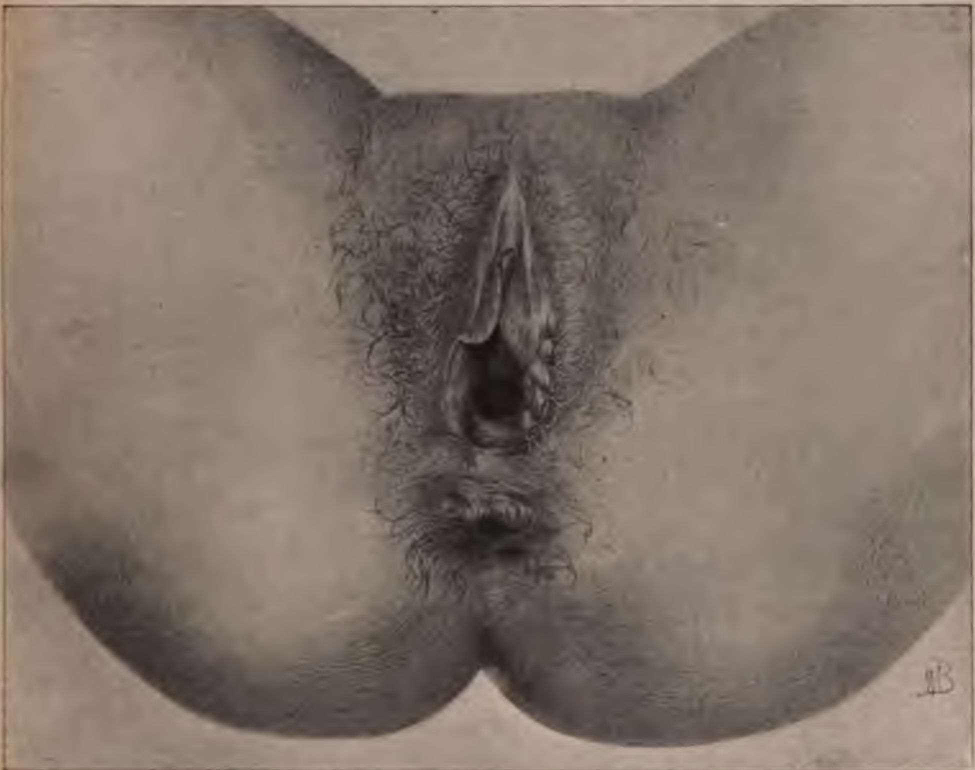


FIG. 137.—LEFT VULVO-VAGINAL GLAND EXCISED AND THE WOUND CLOSED WITH FIVE INTERRUPTED CATGUT SUTURES.

of the wound and bringing the surfaces together, leaving no pockets for the accumulation of blood. The usual dry dressing is placed on the surface, and the sutures are removed in a week.

A detailed report of the cases of cysts of Bartholin's gland which came under observation at the Johns Hopkins Hospital during the years between 1893 and 1903 has been recently published by my colleague, Dr. Thomas S. Cullen (*Jour. Amer. Med. Assoc.*, Jan. 21, 1905). The number of cases was 17, but this is no index of the number that exist, as the majority of patients in this condition are treated in the dispensary and do not come up for operation. The youngest patient was seventeen and the oldest fifty, which is what we should expect, as Bartholin's cysts are, naturally, of most common occurrence during the child-bearing period. The smallest cyst was 5 mm. in diameter and the largest 4 cm.

Abscess of Bartholin's Glands.—The vulvo-vaginal glands are especially liable to become the seat of abscesses forming distinct tumors, in the lower part of one or the other labium, encroaching upon the vaginal outlet. These abscesses have the same topographical relations as the simple cysts just described. The overlying skin may appear normal, or it may be dark red, and injected in color. They generally occur early, in the period of sexual activity, and are found most frequently as a result of gonorrheal vulvitis or vaginitis, and hence among the class of women most liable to impure contacts. Huguier, Velpeau, and Guérin thought that the abscess was often the result of the supervention of an inflammation in a cyst.

The youngest patient I have treated was sixteen years old, and the oldest thirty-eight; it is uncommon to find one over thirty. Velpeau cites a case of forty-five. I do not believe that sexual trauma is a provocative cause, although numerous cases in the newly married have been cited to bear out this theory. The facts to my mind rather tend to show how many men enter into the married state with an uncured gonorrhea. Only about 7 per cent of these cases have been noted in parous women. My own cases show a much larger percentage. One woman had borne four children, the last one only four months before the disease had developed.

The onset of the disease is acute, accompanied with throbbing pain, great local discomfort, and an irritated feeling about the genitals with swelling, and often edema, accompanied by a sense of weight in standing. Locomotion is painful. The pain radiates down the thigh, and there is often inability to sit down without increasing the pain, together with a sense of pressure in the rectum. The gait is slow and straddling and the body bent forward. There are often chills and fever.

The general condition of the patient is one of extreme malaise. Oftentimes there is a history of leucorrhea, offensive or irritating, with painful micturition.

One of my cases had an ulcer 1 cm. in diameter at the fourchette and another in the inferior wall of the urethra, near its internal orifice, 6 mm. by

10 mm. in size. In this case the pus removed from the left vulvo-vaginal gland contained numerous typical colonies of gonococci within the cells. In most cases, however, the microscopic examination of cover slips has proved entirely negative.

The affection usually reaches its height in a few days; it may, however, be several weeks in developing; it tends toward spontaneous recovery by rupture on the mucous surface of the labium, discharging from 15 to 100 c.c. (½ to 3 ounces) of blood, grumous pus, or pure yellow pus. The exit may be by one or several small openings, which tend to close rapidly. But the disease is prone to relapse ("relapsing abscess") in such cases. I have had a patient who presented a history of repeated suppurations extending over many months. Other rare cases give a history of alternation (alternating abscesses) of the affection from one side to the other. Abscesses of the vulvo-vaginal gland are especially liable to recur, because the ultimate ducts become infected, and so the suppurative process may go on indefinitely, until the entire gland is either destroyed or removed by operation.

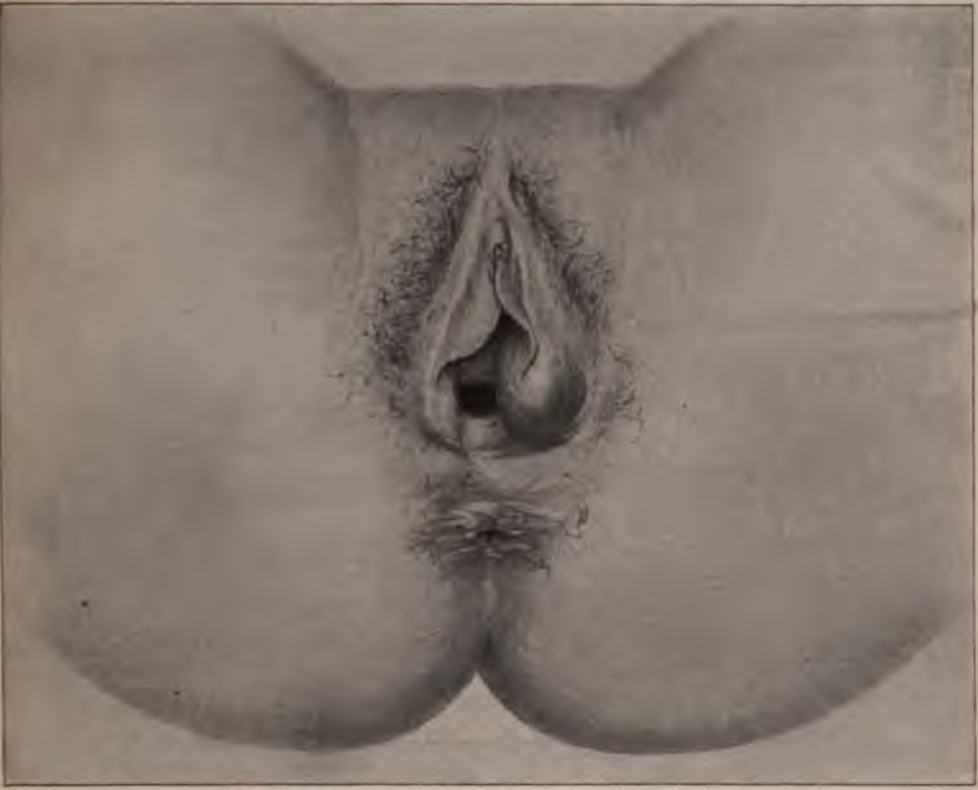


FIG. 138.—ABSCESS OF LEFT VULVO-VAGINAL GLAND.

The distention is in the direction of least resistance, out from the left pubic ramus, partly covering the vaginal outlet.

Occasionally there is no enlargement of the gland visible on inspection. In spite of the fact that there is no evident tumor, there may be a more or less constant escape of pus, serving to keep up an infection of the rest of the genital tract.

The diagnosis, as a rule, is easily made upon associating the symptoms described with the discovery of a painful fluctuating tumor in the lower part of one of the labia. The cases most liable to cause a mistake in diagnosis are those in which the pus sac has thick walls and feels like a small, hard body, the size of a bean, deep in the labium, without fluctuation. I have seen several of these cases in which no diagnosis was made until the pus was let out. In one case the little nodule was even thought to be malignant.

A simple abscess must not be confounded with stercoro-vulvar abscess, due to a rectal fistula extending forward and discharging through a labium. I had one such case, treated by one of my assistants, in which the rectal communication was not recognized until the abscess was opened. This disease ought to be diagnosed beforehand by the brawny induration, extending back on to the perineum, and by the fistulous orifice which can be felt just inside the sphincter. The history also often shows that the distress was first felt in the rectum.

The proper treatment of abscess of the vulvo-vaginal gland is by free incision and packing. After suitably closing, shaving, and cleansing the parts, the abscess is made tense by pressure from behind on both sides, when it is freely opened from below upward. The incision is begun low down in order to give good drainage in the most dependent position.

After evacuation the lips of the incision are separated, the sac wiped clean, and its whole inner surface touched with pure carbolic acid on absorbent cotton. The incision must be kept from closing until the cavity is obliterated; to do this, the cavity is loosely packed with a thin strip of iodoform gauze, which should be replaced every two or three days. It will be noticed that it shrinks with surprising rapidity, holding less gauze each time the pack is removed. After healing, the fine linear cicatrix will be found with difficulty. Sutures and ligatures need not be used.

I object to making an incision on the mucous surface, unless the abscess is at the point of rupturing there, on account of the possibility of a tender cicatrix at this point. When the incision is made here, the anesthetic action of a 20 per cent solution of cocain or ethyl chloride will suffice to blunt the sensibility.

In more than one instance I have known an abscess to rupture spontaneously on the night before the time fixed for operation. The opening thus made by nature in each of these cases was badly placed for the drainage, and too small to allow a pack to be inserted. It was therefore necessary to make it larger by incising it downward.

Where the abscess consists of a small indurated mass with a little pus in the center, the better mode of treatment is by complete extirpation of the gland, if possible without opening it. In one of these cases in my clinic it could only be extirpated piecemeal, on account of the hard, infiltrated surrounding tissue.

he treatment of the cavity thus made is to close it completely, as described the case of cyst.

After the incision, evacuation, and packing, the woman must lie abed for veral days or a week or more. She may go about as soon as she has recoved sufficient strength, and the act of walking is not painful.

Adeno-carcinoma.—I report here in full a case of adeno-carcinoma of the lvo-vaginal gland upon which I operated in December, 1891 (R. S., No. 36, December 18, 1891).

The writings of Gottschalk of Berlin, Werth of Kiel, and Koppe of Mosw have thrown a new light upon cysts of the upper portion of the labia

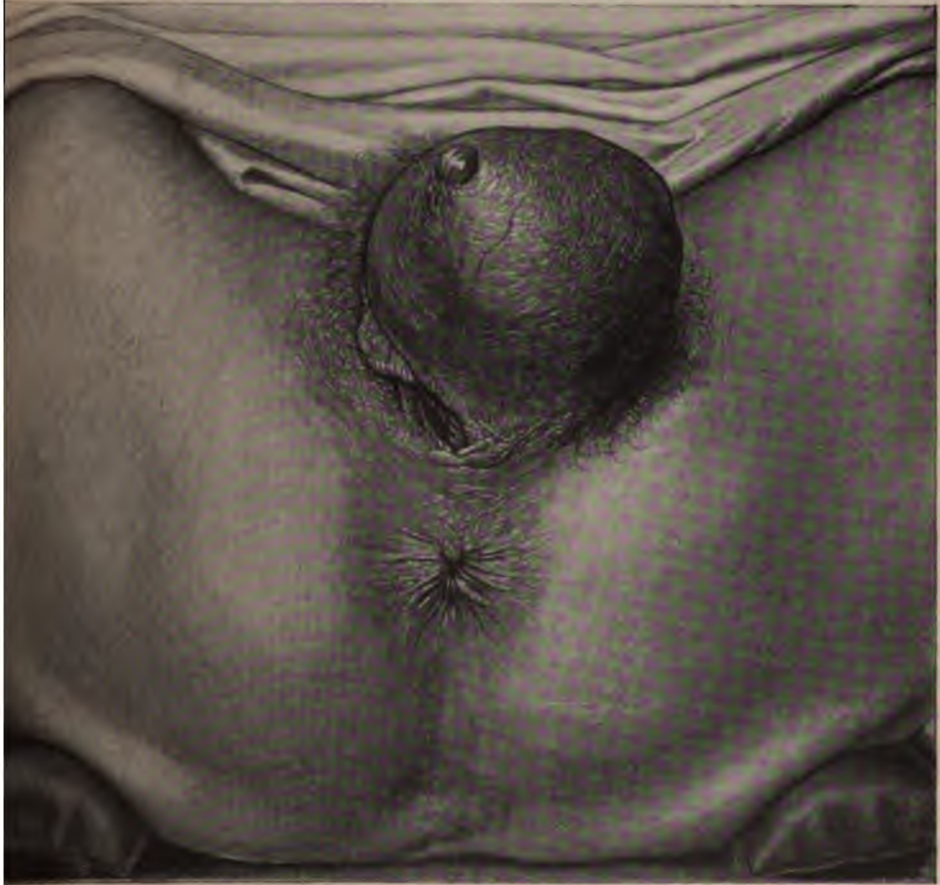


Fig. 139.—Adeno-carcinoma of the Left Vulvo-vaginal Gland.

he skin is thin, the pores coarse and widely separated, and a few hairs are seen scattered over the ce. A large vein courses over the right under surface of the tumor, which contains a bloody fluid.

ora, which can no longer be looked upon as connected with the vulvo-vaginal d. It has been shown that adenoid elements can occur in this region, prob- from the misplacement of epithelial elements in early embryonic life; possible that the following case belongs to this group:

The patient was an American, fifty-five years old. She had had ten children and one miscarriage. The family history was negative. The menses had ceased seven months before she entered the hospital.

At Christmas time, 1890, she noticed a swelling in the left labium majus, which grew slowly for six months, and then for two months it grew rapidly. She had no pain or discomfort, other than a dragging sensation.

Dr. H. Robb examined her upon her entering the Johns Hopkins Hospital during my absence in the summer of 1891, and found a hemispherical enlargement in the left labium majus, irregular and lobulated, as big as an orange, dark red on its surface, and fluctuating. It appeared to have bands of tissue running around it, and in two places the wall was thickened. There was well-marked venous congestion of its surface.

Under the impression that the contents were purulent, it was incised, and a large quantity of whitish and pinkish cheesy blood-stained *débris* escaped, with clots. The cyst wall was lined with similar *débris* and shreds of connective tissue. It was evident that the sac could not be enucleated without great difficulty, and it was therefore cauterized and packed with iodoform gauze, after which an external dressing was applied. After eighteen days pure carbolic acid was applied to the cavity, which showed no tendency to close. After twenty-four days infiltration and thickening were still noticeable, but not so marked as at first. A little whitish exudate was squeezed out.

She went home and returned in four months, when I found a prominent tumor 4 cm. (1½ inch) in diameter occupying the left labium. It was encircled by an injected edematous area with two openings in it having dusky blue margins and discharging sanious fluid. From a third opening, corresponding to the incision made in August, projected a necrotic mass as big as the end of the thumb, which upon being squeezed discharged about 60 c.c. (2 ounces) of necrotic and bloody material.

A microscopical examination of this material showed it to be made up of abundant epithelial cells and small blood vessels. A mucous follicle was found with marked granular fatty degeneration.

The whole left labium was excised, the incision, 14 cm. (5½ inches) long beginning 2 cm. (1 inch) above the symphysis and extending down to the posterior commissure. The wound thus made was at its widest above, 4 cm. (1½ inches), and narrowest below, 2 to 3 cm. (⅘ to 1⅕ inches). The edges of the wound were brought together from side to side by thirteen interrupted silkworm-gut sutures with thirteen catgut sutures between.

The tumor was hardened and examined in the pathological laboratory and found to be a typical adeno-carcinoma. Mackenrodt has reported a case of carcinoma of the left gland as large as a fist and causing great suffering; the orifice of the duct was eaten out and filled with disease (*Centralbl. f. Gynäk.*, 1893, Bd. 17, p. 71). For a case involving the duct and for further reference to the scanty literature upon the subject see O. v. Frisch, ***Monatschr. f. Geb. u. Gynäk.***, 1904, Bd. 19, p. 60.

The following case (M. T., No. 3896, operation October 12, 1895) of a tumor of the left labium majus is interesting because, as there was no evidence of involvement of adjacent glands or tissues, the clinical history pointed strongly to ulceration of a cystic Bartholin's gland.

The ulcerated area suggested a malignant tumor, but was not diagnostic; the gland and a wide area of tissue were excised.

The patient first noticed a slight, hard, nodular, painless swelling in the left labium in the spring of 1894. This gradually enlarged until, about six months before she was seen, it took on a more rapid growth, reaching the size of a small lemon, and for three months it was slightly ulcerated. She had a sharp pain and a burning sensation throughout the enlargement, and the whole mass at times became sore, the tenderness extending to her thighs. The ulcerated surface bled considerably at times, causing some relief from pain.

Examination.—The vaginal outlet is occluded by a large tumor of the left labium majus. The tumor is reddened, fluctuating, and on its vaginal surface presents an ulcerated area from which blood oozes. The tumor is well circumscribed in the area occupied by the vulvo-vaginal gland and does not infiltrate the surrounding tissues. No enlargement of the inguinal glands on either side.

The cystic gland was excised with a wide area of skin around it; the tumor was lifted well out of its bed and an abundance of underlying tissue removed with it. All bleeding points were caught separately and ligated with catgut, and the wound closed with interrupted catgut sutures.

Pathological Report.—Myxo-fibro-sarcoma of the Labium Majus.—The tumor is globular, 5.5 cm. in diameter, and for the most part smooth; the skin surface is an irregular elevation 3 by 2.5 by 1 cm., presenting a rough, eaten-out appearance, with a deep excavation in the center. With the exception of this nodule, the tumor is surrounded by a capsule; its central portion consists of a fibrillated, semi-gelatinous tissue, having bands of denser tissue extending across it and partly around the periphery. The nodule on the surface consists of tumor substance which has broken through the capsule. Microscopically the tumor consists of loose fibrillated mesh-work, whose interspaces contain a substance which, with hematoxylin and eosin, is tinged blue. The cells, also tinged faintly blue, are long and spindle-shaped or branched, with elongated vesicular nuclei. Many hyperchromatic and irregular budding nuclei are also present, several times larger than the average. In the denser bands the cells are more abundant and are occasionally arranged in whorls. Cells of the lymphoid variety in considerable numbers are evenly distributed throughout the tissue. The tumor is vascular throughout. Where it penetrates the capsule it is more vascular and especially rich in cell elements. The surface of the elevation closely resembles granulation tissue. From this description it will be seen that the growth is a sarcoma, and that it has to a great extent been localized by a dense fibrous capsule; at one point, however, it has penetrated this and extended to the surface.

Fibroma Molluscum.—Fibroma molluscum (see Fig. 140) is often found on the genitals, as on other parts of the body. It is commonest on the labia and rare on the perineum and fourchette, where it is shown in the case figured.

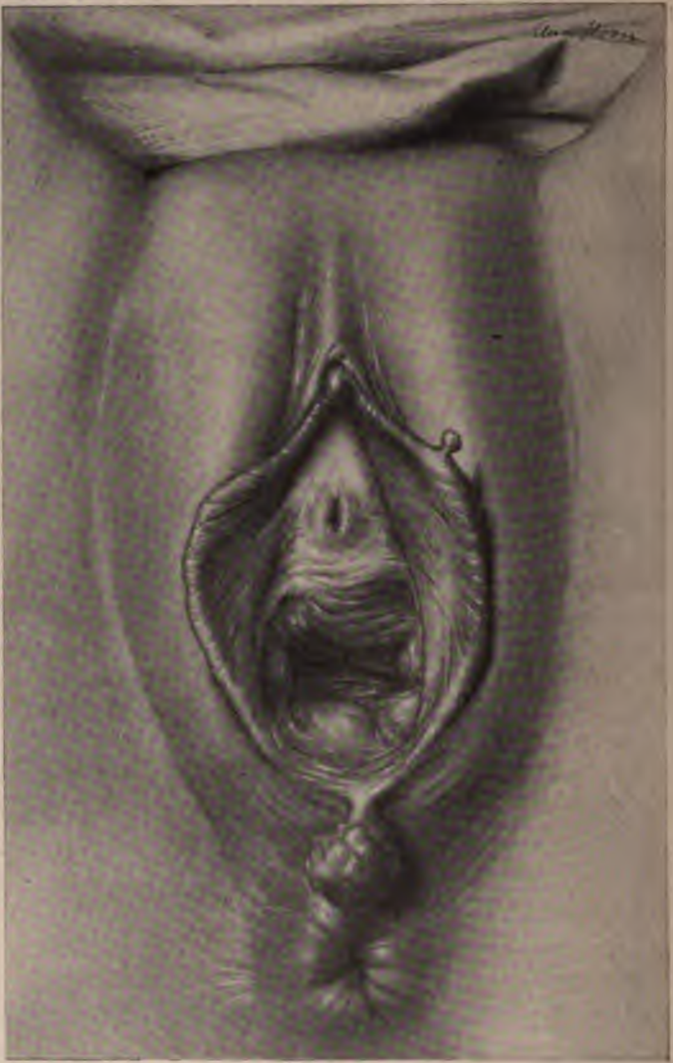


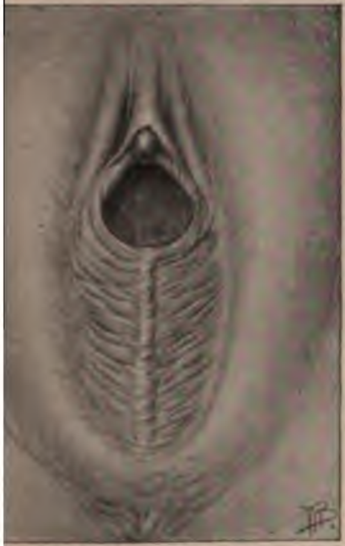
FIG. 140.—RELAXED VAGINAL OUTLET SHOWING A FIBROMA MOLLUSCUM HANGING FROM THE POSTERIOR COMMISSURE.

AFFECTIONS OF THE VULVAR MUCOSA.

Congenital Cohesion.—Abnormal adhesions between the mucous surfaces the right and left sides, inside the labia majora below and the labia min above, are not rare, although but seldom mentioned.

They have been described by Sänger, of Leipzig, under the name c atio labiorum (*Centralbl. f. Gyn.*, 1891, No. 50), and by Bokai ithelial union of the labia." They are usually found in small children pear to be either congenital or to result from inflammation, with de- on of the epithelium, followed by adhesion. Four cases of the affection ome under my notice, the youngest a little girl twenty months old, and est one of six years; the difficulty was first discovered by the mother in nstance.

the little girl twenty months old, seen in 1890, figured in the text 141), the labia majora were well formed; the hymen and vaginal sur-



—Agglutination of the Labia in a Little Girl.

is a distinct raphe in the middle, with a nt slightly furrowed membrane in both ich conceals the urethra and the hymen.

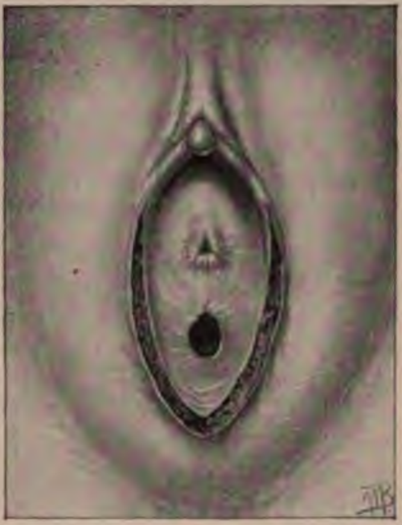


Fig. 142.—Agglutination of the Labia.

The same case after division of the membrane; urethra and hymen exposed.

vere completely hidden by a thin, dark membrane with fine lines upon it, ng upward and outward from a well-defined central vertical raphe. The aces of the labia minora were the rudimentary folds covering the clitoris. ans of the clitoris was well developed. Just under the glans was the urinary opening, 3 mm. in diameter, the sole outlet for urine and vaginal ons. A probe introduced through the opening and behind this mem- showed the depth of the anomalous interlabial septum to be 15 mm. On g the septum forward the raphe appeared white. The vagina was 5.5 ¼ inches) deep.

ook upon this case as simply an abnormally long fourchette, as there history of any inflammatory affection, but especially because of the rmed raphe, which would not have been found on any adventitious mem- In two other cases the membrane was similarly developed and appeared ongenital.

Treatment.—The membrane was cut down to its base, exposing a normal urethra and hymen (Fig. 142). The incision left a linear V-shaped wound on the mucosa. One suture was required to control bleeding.

Inflammatory Cohesion of the Mucous Surfaces.—A little girl of six presented herself at the clinic with an occlusion of the outlet, first detected when she was a year old. On inspection, a line of granular erosion was found in the middle of the vulva posteriorly, and the labia were extensively united on their mucous surfaces, concealing the site of the hymen and urethra and the whole clitoris, but leaving a minute orifice just over the site of the clitoris. The vulvar mucous surface throughout its entire length was adherent. Under the influence of chloroform the adherent surfaces were stripped apart with a probe, exposing a vaginal orifice 10 by 5 mm., the urethra, and the clitoris. Lateral adhesions of the hood to the glans of the clitoris were also freed. Sometimes the adherent surfaces may be separated by using cocaine instead of a general anesthetic.

Pruritus, or Vulvitis Pruriginosa.—Pruritus is especially a disease of the old, and is one of the most distressing of all the gynecological affections not endangering life. It consists in a subacute inflammation of some portion, or all of the external genitals, involving the deeper layers of the skin and the nerve endings; it is therefore a dermato-neuritis. I have adopted the term vulvitis pruriginosa, suggested by Sänger, of Leipzig (v. *Ges. f. Geburtsh.*, Leipzig, Oct. 16, 1893), as more correctly describing the morbid process. The common name "pruritus" means simply "itching" and nothing more, and merely describes a symptom common to many affections.

While the whole vulva may be involved, the disease is oftenest localized in the free portion of the clitoris with its coverings, the neighboring surfaces, and the labia minora. With these structures, the whole inner surface of the vulva may be involved, the hymen forming the limit of its extension inward. The skin surfaces of the labia majora also become involved in aggravated cases.

I have seen the disease confined to small areas about the clitoris and fourchette; in another case the most marked alterations were in the labio-femoral folds.

The changes induced are a thickening due to an inflammation of the connective tissue in the corium. The mucous surfaces have a thick, dead-white, withered appearance. The glans clitoris often completely disappears, leaving in its place beneath the thick, white preputial folds a little pit. These white surfaces, as well as the labia on their outer surfaces, are streaked with fissures due to scratching; these fissures are pink at the bottom and are generally arranged vertically.

The real causes of pruritus are not known, although a number of provocative causes and conditions are well recognized.

In every case of intractable pruritus the urine should be examined for sugar, as some of these cases are diabetic in origin; this is due to the fermenation of the urine, which then acts as an irritant upon all the tissues with which it comes in contact.

A sero-purulent discharge from a myomatous uterus proved to be the exciting cause in one instance; all attempts to relieve the pruritus failed, until finally the patient was so harassed that she consented to operation. The uterus was extirpated for the myoma and the pruritus ceased.

Fissure in ano may be accompanied by pruritus of the vulva, which will be cured by the healing of the fissure.

An attempt has been made, without success, to demonstrate a bacterial origin. The initial stages may often be attributed to irritative vulvar and vaginal secretions, after which the more aggravated form of the disease develops from the repeated mechanical insults in rubbing and scratching the parts.

The proper treatment of the severer cases of chronic pruritus with the changes described is, as advised by Sänger, by excision of the diseased area. The free mobility of the external genitals and adjacent parts allows almost any defect created by an excision to be readily covered.

The following case will serve as an illustration of the operation where the disease involves all the external genitals except the skin surfaces of the labia majora:

The patient was a married woman, fifty-seven years old, and a nullipara; she had had one miscarriage twenty-five years previously; menopause sixteen months before operation. When younger she had had a milky leucorrhea, but this had ceased for several years. She had suffered from itching in the genitals for twenty years, at first always connected with the menstrual period, beginning a day before and lasting twelve days; for three years past there had been a constant intolerable itching and burning, with burning micturition, keeping her awake almost every night, and nearly driving her insane. During this period she had noticed the formation of little blisters between the labia, which would break, leaving raw surfaces, discharging pus. These surfaces rarely appeared to heal.

I found the inner surfaces of the labia majora covered with irregular white patches of thickened epidermis, more abundant above, extending from the upper commissure down to the lower part of the vaginal outlet; below this the surface was covered with a reddish glaze. At the angle between the inner mucous and external skin surfaces of the labia—that is, on the margin of the disease—was a line of whitish scales with slightly elevated edges. A few small, superficial ulcers were scattered over the white area. The labia minora were withered down to insignificant rudimentary folds. The clitoris was completely concealed beneath the thickened diseased tissue, and only a little hole showed the spot where the glans is usually found. The hymen was entirely absent; the disease was limited by a line encircling the vaginal outlet and including the urethra, which was not involved.

The whole of this diseased surface was excised under anesthesia by an operation lasting thirteen minutes. After a prolonged, painstaking scrubbing, an incision was made, outlining the area to be removed, beginning at the commissure above and extending down on either side, along the angle between the outer and inner surfaces of the labia, to the level of the vaginal floor. From this point the incisions were carried up to the vaginal outlet and around it, meeting over the urethra.

The area excised, roughly described, resembled a spearhead pointing upward with a deep notch at its base. The whole thickness of the skin thus outlined was rapidly dissected away, the labia minora and the body of the clitoris being removed with it. The dissection was made from above downward by catching the apex above with forceps and drawing it down, detaching the flap with rapid strokes of the knife. Six artery forceps had to be applied to bleeding

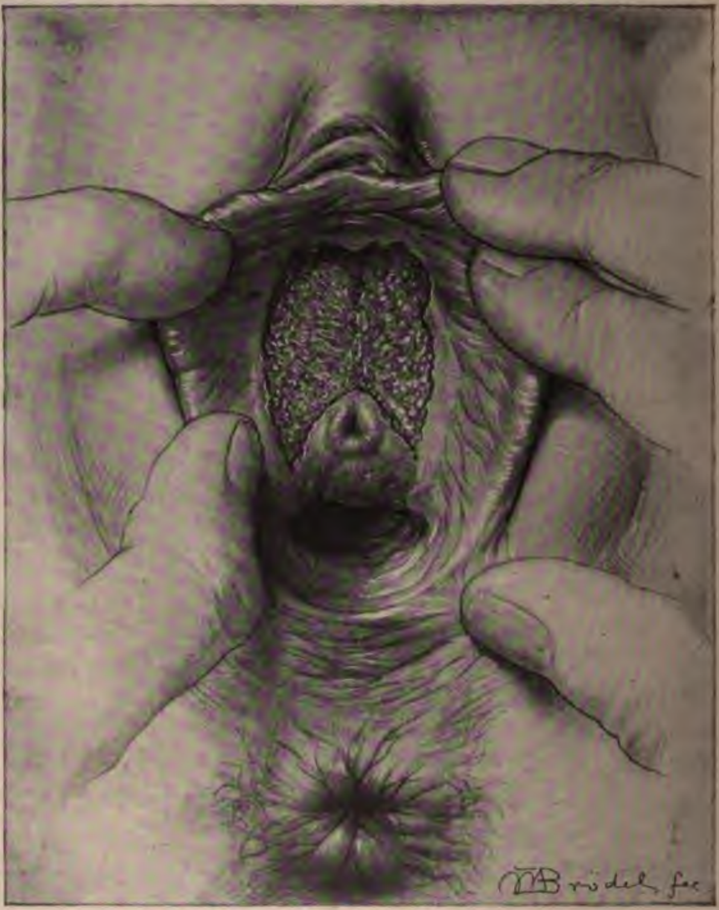
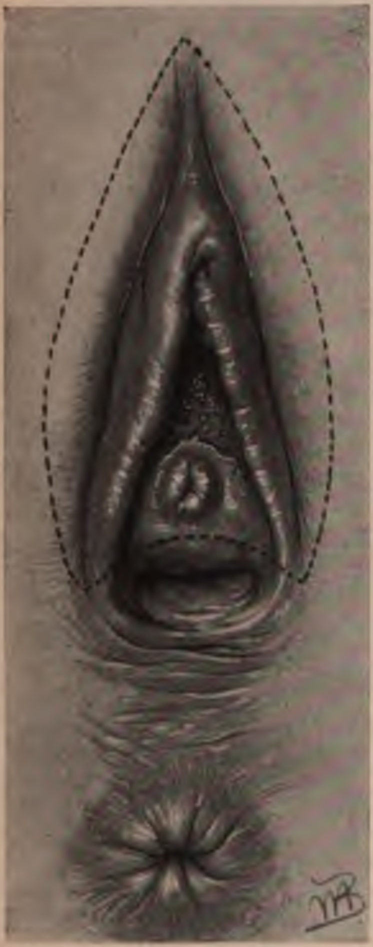


FIG. 143.—TUBERCULOSIS OF THE VESTIBULE.

The flat pinkish mammillated diseased area occupies the entire vestibule, encroaching on the upper margin of the urethra and extending slightly into the anterior vaginal sulci. There is no thickening or infiltration of the edges, which are raised about 2 mm. above the level of the diseased area. The clitoris and the adjacent parts are red and swollen.

essels. The bleeding from the cut crura of the clitoris was surprisingly small. o vessels were tied; all the hemorrhage was controlled by so placing the tures approximating the edges of the wound as to catch the bleeding vessels n the loop, and then tying the sutures tightly.

The outer surfaces of the labia were now drawn together above, and in as ar as the vaginal outlet on each side below, with silkworm gut sutures about 1 cm. apart. The line of union formed resembled an inverted Y (⅄), the point of divergence being 1 cm. above the urethra. There was no difficulty in covering the defect, and there was no tension on the sutures.



ig. 144.—Area of Excision of Tubercular Disease shown by the Dotted Line: this included the Clitoris, both Labia Minora, and the Entire Vestibule, with the Anterior Part of the Urethra.

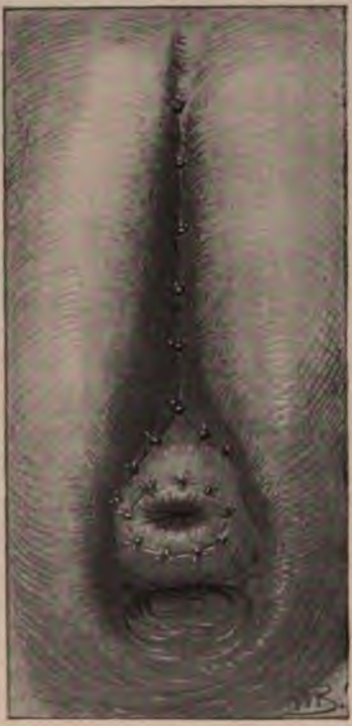


Fig. 145.—Showing the Union of the Wound above the Urethra in the Form of an Inverted Y.

The patient was at once entirely relieved of her distressing symptoms. The utures were removed on the tenth day, and the wound found to have healed y primary union throughout.

The removal of the whole vulva in the more extensive cases is performed n the following manner:

An oval incision is made in the middle line in the mons veneris, starting at the upper limit of the disease and continuing down on either side, so as to include the whole of one or both labia majora, meeting below at the posterior commissure, or on the perineum or even at the anus, according to the extent of the disease downward. Another incision encircles the vaginal outlet in the position of the hymen, beginning above the urethra. The whole area between these two incisions is rapidly excised from above downward, and bleeding vessels caught with forceps. The edges of the upper part of the wound are brought together from side to side with silkworm gut sutures, down as far as the level of the urethra. Below this point they are drawn in on either side and attached to the vaginal outlet, covering the whole defect.

Tuberculosis of the Vestibule.—Tuberculous disease of the external genitals is extremely rare, not more than three or four cases having been recorded. This disease is usually associated with pulmonary phthisis.

I have seen one case of tuberculosis of the vestibule. The patient, Mrs. S., a widow, aged fifty-five, complained chiefly of stinging pain on urination, caused by the urine flowing over the ulcerated area. A small ulcer first appeared one year before coming to me; this increased steadily in size until it occupied an area as seen in Fig. 143, Mrs. S. (Path. No. 1756). The specimen removed consists of a triangular piece of tissue, the margins of which are covered by mucous membrane. The central portion presents an eaten-out appearance, and the deeper tissues are infiltrated, though not markedly indurated. Situated in this ulcerated area is the urethral orifice surrounded by a narrow band of smooth mucous membrane. Histologically, the surface of the ulcer is made up of the characteristic tubercular granulations, while typical tubercles are scattered throughout the deeper tissues, some being found immediately beneath the urethral mucous membrane. Tubercle bacilli are demonstrable in small numbers.

Diagnosis.—Tuberculosis of clitoris and vestibule.

The operation is shown in Figs. 144 and 145.

CHAPTER XIV.

DISEASES OF THE HYMEN.

1. Anatomical classification (p. 267).
2. Structure (p. 267).
3. Rupture (p. 267).
4. Embryology (p. 268).
5. Pathologic conditions (p. 268): Inflammation. Traumatisms. Malformations. Neoplasms.

Anatomical Classification.—The hymen is a membranous structure situated at the juncture of the vulva and the vagina and partially obturating the vaginal orifice. Its macroscopic appearance in the majority of cases is that of a semilunar fold. Next in frequency to the crescentic form is the annular variety, in which the hymeneal opening is circular in shape. Other forms of the hymen are found less often. The septate hymen has two openings separated by a bridge of tissue. The cribriform hymen shows a number of small openings resembling a sieve. If the edge of the hymen projects markedly outward, we speak of it as an infundibuliform hymen. Deep furrows characterize the lobate hymen; and papillary excrescences upon the free edge constitute the fimbriated hymen. The two last forms are of great practical importance from a medico-legal standpoint, because a lobate hymen may simulate defloration, while a fimbriated hymen may be mistaken for condylomata acuminata. The microperforate hymen has nothing more than one or two very minute openings (see Fig. 146). Finally, in the imperforate hymen, the vaginal orifice is completely occluded.

Structure.—The color of the hymen is white or light pink, and contrasts, as a rule, with the deeper color of the vulva. The thickness and consistence of the hymen vary widely, from a membrane as delicate as tissue paper to a ligamentous or even a cartilaginous or "bony" structure.

Microscopically, the hymen is composed of a dense connective tissue stroma covered on either side with multiple pavement epithelium. Both surfaces are set with numerous filiform and conical papillæ which decrease in size with advancing age. The stroma contains capillaries, smooth muscular fibers, nerves, and a large amount of elastic tissue. There are also glandular structures found within the tissue of the hymen which may give rise to the formation of cysts.

Rupture.—The elasticity of the hymen is, in rare instances, so great that it remains unruptured even at childbirth. In other cases it has been found so unyielding that it presented an obstacle to delivery, thus necessitating an incision. As a rule, the first coitus ruptures this delicate membrane, and it is also sometimes torn by accidental injury, such as falling astride of some object or by violent exercise. The number of tears which divide the hymen into "lobes" varies in individual cases. Healing takes place with considerable new formation of elastic and connective tissue. Such tears rarely unite; if union does take place, a cicatrix may remain. Parturition definitely destroys the form of the hymen and only small remains—carunculae myrtiformes—are left. Gellhorn, in his "Anatomy, Pathology, and Development of the Hymen" (*Amer. Jour. Obst.*, 1904, vol. L, p. 145), ascribes the formation of caruncles to the action of the elastic tissue; he divides the elastic fibers into two groups, one more or less circular, surrounding the hymeneal opening, the other extending radially toward the base. If, in childhood, the hymen is torn into a number of pieces, each piece retracts owing to the more powerful action of the radial fibers. For some time thereafter it is possible to pull each caruncle to its original length, but after long standing, retraction results in an atrophy of the caruncle through insufficiency of the circulation.

Embryology.—The development of the hymen is still an object of discussion. According to Kölliker, Dohrn, Nagel, Budin, and Gellhorn the hymen is the lowest end of the vagina, and is produced by the Müllerian ducts, which, after their fusion, project into the urogenital sinus as the cone-shaped Müllerian eminence. The formation of a lumen proceeds from above downward, and by breaking into the sinus, causes the hymeneal opening.

Pathology.—The pathological conditions of the hymen may be divided into: (1) Inflammations; (2) traumatisms; (3) malformations; (4) neoplasms.

Inflammation.—Inflammatory affections of the hymen are usually secondary to inflammatory processes ascending from the vulva. Gonorrheal infection, contamination with the colon bacillus, or irritation from lack of cleanliness may cause inflammation. Furthermore, irritating discharges derived from inflammatory conditions of the vagina and uterus may affect the hymen. Acute infectious diseases such as cholera, typhoid fever, variola, scarlatina, measles, etc., not infrequently produce secondary inflammations of the entire genital tract and play an important etiologic rôle in the origin of acquired atresia. The inflamed hymen has a markedly reddened appearance and bleeds easily; occasionally small excoriations are seen. The surrounding tissues have more or less the same appearance. The treatment must necessarily attack the primary cause. If special treatment of the inflamed hymen becomes necessary, on account of intense pain, a small piece of cotton saturated with a 10 per cent cocain solution is pressed against the hymen for a few minutes, after which it is cauterized with a 2 per cent solution of nitrate of silver, and protected against further irritation by a 10 per cent boracic acid ointment. This treatment may, if necessary, be repeated after three days. If, after infectious diseases, a purulent discharge from the genitals is observed, the physician should make an examination in order, if possible, to prevent inflammation with subsequent conglutination of the eroded vaginal walls and hymeneal folds. Vaginal douches, such as solutions of boracic acid, permanganate of potassium, or alum are useful for their astringent qualities. But far superior to the ordinarily employed douches is the liquor aluminii acetici of the German Pharmacopoea, in the proportion of 1 ounce to 1 quart of water, at body temperature, given twice daily until the discharge subsides and complete restoration of the vaginal mucosa has taken place. By this treatment serious complications may be prevented.

In some cases, a thick, tough hymen forms a decided obstacle to sexual congress. Futile attempts at coitus are followed by inflammation and small fissures, which, by way of reflex, may cause spastic contractions of the muscles of the pelvic floor, known as vaginismus. Such a malformation is generally soon discovered and easily relieved by a sharp incision with the surgeon's knife. In the figure (146), however, I show a case in which this barrier still existed after nine years of married life. Treatment consists in cauterization of the fissures with the Paquelin cautery, in narcosis, and in divulsion of the vaginal entrance. Should a deep tear in the hymen cause a copious hemorrhage, a catgut suture may become necessary.

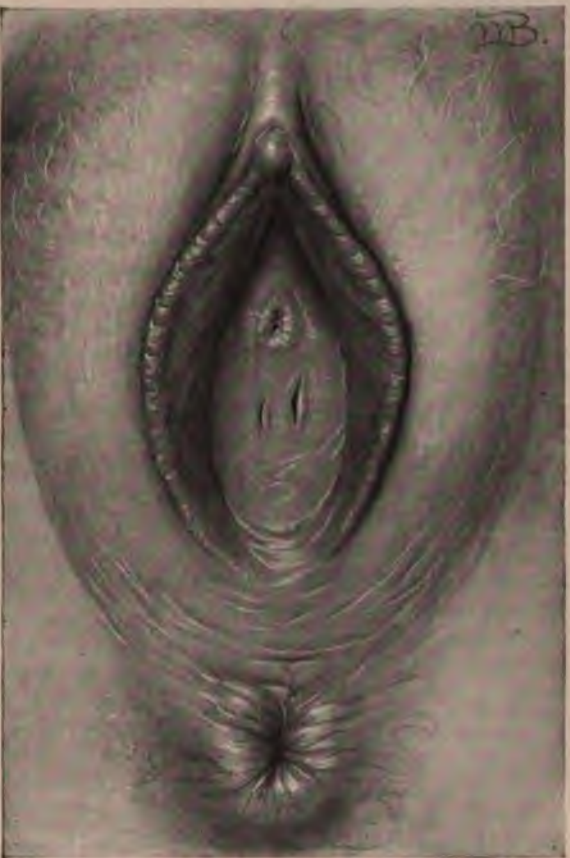


FIG. 146.—HYMEN INTACT AFTER NINE YEARS OF MARRIED LIFE.

The membrane was thick and tough and perforated by two small orifices. Oper. JUNE 5, 1897.

Traumatism.—Tears of the hymen are more frequently the result of violent or abnormal coition. They are, as Veit just remarks ("Die Erkrankungen der Vulva," *Handbuch der Gynäkologie,* 1898, Bd. 3, H. 1, p. 200), to be distinguished from the physiologic injuries incident to the first cohabitation or childbirth. In such cases of abundant hymeneal hemorrhage adjacent parts are always injured. In one such case, a young, newly married woman was brought into the clinic almost pulseless. Upon examination a deep tear of the hymen was found which began in the left upper quadrant and extended through the paraurethral tissue into the base of the clitoris. There are a number of instances recorded where hymeneal hemorrhages terminated fatally. The wound should be sewed up, and intercourse be interdicted for four weeks.

Malformations.—From a practical standpoint, atresia is at once the most frequent and the most important of the malformations of the hymen. Hymeneal atresia is either congenital or acquired. The congenital atresia is always associated with anomalous development of the internal genital organs and rarely causes any symptoms. In the majority of cases, however; the imperforate hymen is the result of vaginal inflammation acquired in earliest childhood. Gonorrheal vulvo-vaginitis is the usual cause. In the observation reported by Madge (*Trans. Obst. Soc.*, London, vol. xi, p. 213), four sisters, two to ten years old, had hymeneal atresia while the fifth child, a boy, had phimosis. This coincidence of affection was most likely due to some factor acting on the five children in common, such as baths, sponges, or towels. The vagina, uterus, ovaries, and tubes are well formed and functionally active in such cases.

This condition of the hymen is rarely recognized until puberty, when, owing to the failure of the appearance of the menstrual secretion, suspicion is excited and an examination at once reveals the anomaly. It may, however, be discovered in quite young children by the accumulation of mucus within, causing the hymen to pout and appear as a whitish sac between the labia beneath the urethra, becoming more prominent when the child cries. If this sac is cut open with a pair of scissors, a little mucus is discharged and no further difficulty is experienced. Such a case has recently been reported by Commandeur (*Mém. et bull. soc. d'obstétrique de Paris*, February 18, 1904). The milky fluid consisted of vaginal secretion and contained a large amount of glucose.

After puberty the condition is quite different; at each menstrual period the secretions are poured into the uterus and vagina, the more fluid parts are absorbed, and a thick, tarry substance remains. In the course of time, ordinarily between the ages of seventeen and twenty, the vagina may become distended into a sac large enough to fill the pelvis. The upper end of the sac is formed by the expanded uterus, which is pushed upward and is situated, as a rule, somewhat to the right of the middle line. The external os becomes distended until it entirely disappears, so that the cervical canal is apparently but a continuation of the vagina. The distinction between the uterine cavity proper and the cervical canal is marked by the internal os uteri, which, although much dilated, preserves its identity. One of the most important complications to be anticipated is the distention of the uterine tubes due to the damming of the retained menstrual secretions. We may assume that the same inflammatory processes which, in childhood, cause the occlusion of the hymeneal membrane, also tend to the conglutination of the abdominal ends of the tubes. Thus the tubes become blind sacs which fill up with blood after the uterine cavity is distended *ad maximum*.

The symptoms of retention of menstrual blood with consecutive formation of hematokolpos, hematometra, and hematosalpinx, consist, in the beginning, in slight pain in the lower abdomen, occurring at regular intervals of four weeks. Gradually, these menstrual disturbances which are not accompanied by the appearance of the menstrual flow, increase in intensity and duration. They take on the character of labor pains and of paroxysms during menstruation, but they also persist in the intermenstrual periods. Furthermore, there is difficulty in urination and defecation.

The diagnosis is based upon both the anamnesis and symptoms and upon examination. The changes at the lower end of the vagina are quite characteristic. There is a marked, bulging, convex tumor of dark brown color, protruding between the labia, which fluctuates distinctly upon palpation; posteriorly it is limited by the perineum, laterally by the inner surfaces of the labia, and anteriorly it reaches to the posterior margin of the urethra. If the tumor be sufficiently large to fill the lower abdomen—rising, as it may, as high as the umbilicus—the wave of fluctuation is readily transmitted from above downward as far as the tumor at the vulva. The rectal examination reveals an elongate sac filled with fluid, occupying the position of the uterus and conforming in its general direction to the axis of the pelvis. Great care must be taken during examination not to rupture the thin tubal sacs, lest a fatal hemorrhage or an attack of peritonitis be induced.

The treatment requires special precautions. Lives have been repeatedly lost from sepsis coming on rapidly after opening these accumulations, especially where the tubes have been dilated. The blood adhering to the sac and the thin walls, together with the sudden change in the pressure upon the blood vessels, affords nutrient material for sepsis and a ready avenue for its entrance into the neighboring peritoneal cavity through necrosis of the thin walls. This danger will be avoided by a thorough cleansing of the field, by taking care not to infect the tract while operating, and by a careful packing with iodoform gauze, so as to protect the field for some days after operation.

After cleansing the external genitals, the bulging membrane is opened by a crucial incision, dividing it into four triangular flaps. The thick, tarry fluid is allowed to escape slowly; the canal above is washed out from five to ten minutes with a saturated boric acid solution, introduced through a long, curved, glass douche nozzle. Pains must be taken to empty the whole vaginal and uterine cavities of all the blood. An abundance of iodoform and boric powder is dusted into the vagina, and iodoform gauze loosely packed in from the vaginal vault to the outlet. The urine is drawn, the powder is sprinkled over the outside, and a pad of sterilized cotton laid on, held in place by a T-bandage. These dressings may be left in place four or five days or even longer, provided all is going well, and they do not become saturated earlier. At any time that they are wet with secretions they must be changed by bringing the patient conveniently to the edge of the table or bed, under a good light, withdrawing the pack with forceps, and reinserting it with a packer, using every care to avoid contact of the gauze with fingers, buttocks, etc. By this mode of treatment sepsis will be kept out and one great danger eliminated.

Another equally serious complication is the possibility of a rupture of the tubal sacs, with subsequent internal hemorrhage. For this reason Veit suggests, in cases where the presence of an hematosalpinx is established, opening the abdomen first and extirpating the tubes, before the evacuation of the blood from the vagina and uterus is accomplished.

Neoplasms.—Growths of the hymen are rare. There is but one case of sarcoma of the hymen recorded, observed by Sänger. To the benign neoplasms belong the cysts, of which Gellhorn (*l. c.*) has collected seventeen cases from literature. These cysts occur on either side of the hymen, but more frequently on the outer surface. They may attain the size of a cherry and are occasionally multiple. They are of no practical importance and demand interference only when the patient is alarmed. Simple puncture is sufficient to effect a cure.

CHAPTER XV.

RUPTURE OF THE RECTO-VAGINAL SEPTUM AND RELAXED VAGINAL OUTLET.

1. Physiological support of the vaginal outlet (p. 273).
2. Operations for recent injuries to the vaginal outlet (p. 275): External tear; internal, and combined external and internal tear; complete tear of recto-vaginal septum.
3. The intermediate operation for injuries to the outlet (p. 280).
4. Old complete rupture of recto-vaginal septum (p. 282): Operation for the same. Vaginal flap; liberation of rectum. Union of sphincter without perineal operation.
5. Relaxed outlet (p. 292): Operation for the same.

RUPTURE OF THE RECTO-VAGINAL SEPTUM.

The Physiological Support of the Vaginal Outlet.—The "vaginal outlet," called "outlet" with reference to its parturient function, or "introitus," "inlet," or "vaginal entrance," from its sexual function, forms the inferior extremity of the vaginal canal communicating with the external genitalia beneath the pubic arch. While the vaginal canal above and within the pelvis is broader and more capacious, inferiorly it suddenly narrows down to an outlet which is a canal 4 to 5 cm. (2 inches) long.

The posterior wall of the vagina in a sagittal section of the body forms a flattened **S** with the convexity of its lower curve directed forward behind the pubic arch. The peculiar funnel shape of the vagina—broad above and contracted below—appears most distinctly upon placing a woman who has never borne children in the knee-chest position and letting in air, when the intrapelvic portion of the vagina will balloon out, while the outlet or introitus remains tightly contracted, closely hugging the pubic arch.

The mechanical theory advocated by some writers, that the closure of the outlet and its snug position beneath the pubic arch are dependent upon a thick wedge of tissue, a so-called "perineal body," acting like a cork plugging a bottle, is erroneous. In consequence of this false conception absurd and unnecessary operations have been devised and extensivly employed for injuries in this situation.

The error of this prevalent notion is evident upon examining the virginal outlet, where the vaginal outlet and anus are seen, both lifted well up under the pubic arch, and upon introducing the index finger into the vagina the pubic arch is felt in front, while posteriorly a broad, rounded, resilient band of muscular tissue, the levator ani, stretches behind the outlet from the right to the left pubic ramus.

This examination readily demonstrates the important fact that the vaginal introitus is but a narrow chink between this posterior muscular band and the pubic arch. By making backward pressure upon the posterior wall of the vagina within the introitus the band yields, to return to its former position as soon as the pressure is withdrawn.

The fourchette and the supposed "perineal body," lying between the fourchette and rectum, should now be closely examined by placing the index finger of one hand just within the vagina and the other in the rectum and palpating so as to measure the size and thickness of these structures. It will be found that they are but slight tissues incapable of giving any support to the superjacent organs.

The real supporting mechanism of the outlet is not the perineal body, but the anterior portion of the levator ani muscle. This broad, rounded muscle arises on either side of the inner surface of the pubic ramus and passes back around the lateral vaginal wall to unite with its fellow behind the rectum, its fibers being intimately interwoven with the lateral walls of the rectum. These important anatomical relations may readily be detected in the living subject

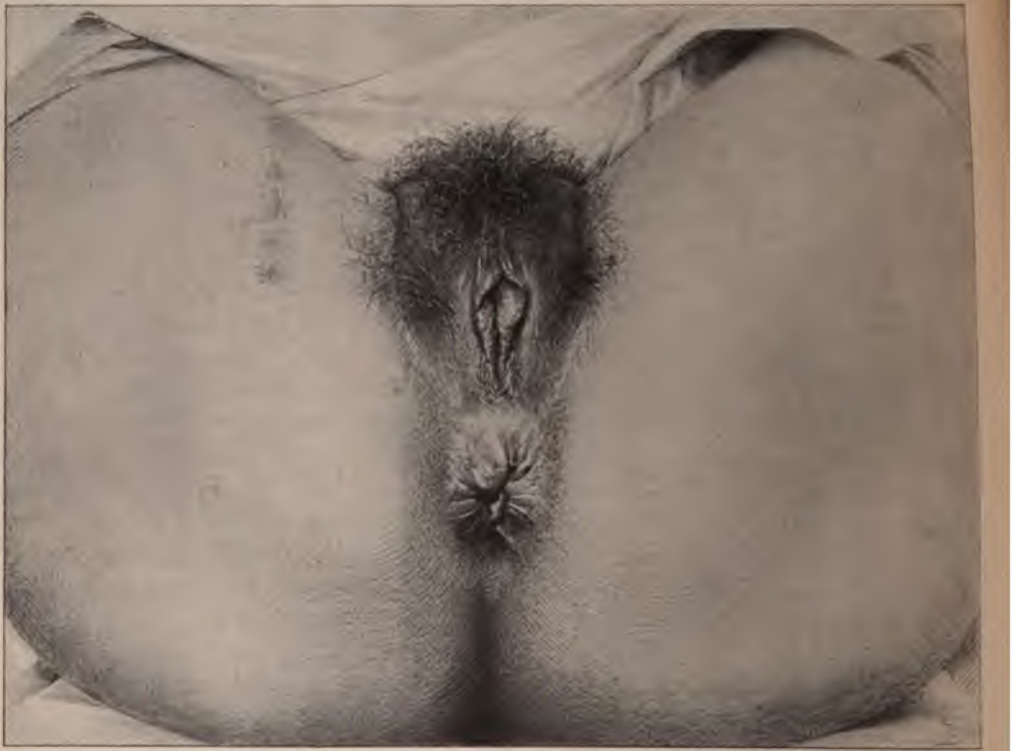


FIG. 147.—NORMAL VAGINAL OUTLET IN A NULLIPARA.

The vagina is completely hidden, and there is no flattening across the anus and the gluteal furrow as in the case of a relaxed outlet. The little concentric furrows surrounding the fourchette below are not, as a rule, found in the virgin.

by making pressure in each lateral sulcus of the vagina while one finger lies within the rectum.

From what has just been said, it is apparent that the vaginal outlet has no direct means of closure such as would be afforded by a powerful sphincter muscle, but depends for its support upon the indirect action of the levator muscle. For by the contraction of this muscle the lower end of the rectum is tightly lifted up under the pubic arch and the vagina flattened out and held up between the two. It is further important to notice that the position of the plane of the pubic arch, in front of the plane of the levator fibers, renders the closure far more efficient. It is this arrangement which gives the sigmoid curve to the lower extremity of the virginal vagina.

With rare exceptions, the important injuries to the vaginal outlet affect its caliber alone, and arise during parturition. It is not difficult to appreciate the rationale of this, when we recall the fact that during the passage of the child's head, the outlet, normally from 2 to 3 cm. ($\frac{1}{2}$ to 1 inch) in diameter, is dilated until it forms a ring 28 cm. (10 or 12 inches) in circumference. In numerous instances, instead of the gradual and all-round dilatation of the outlet produced by repeated impacts of the advancing and retiring fetal head, the yielding is sudden and in one place, with rupture of the muscular fibers in consequence. The parturient canal represents a funnel within a funnel, the uterus and cervix representing the upper funnel, set within the upper vagina and outlet as the lower funnel. In consideration of this fact it is surprising that both the contracted outlets, cervical and lower vaginal, are not more frequently damaged during the passage of the large fetal ovoid. Injuries to the outlet similar in character often result from the removal of large submucous myomata lying within the vagina. The vaginal outlet may be injured from without by a variety of accidental causes, such as falling upon a chair post, or being gored by cattle, or in a child from sliding down a haymow on to a pitchfork handle, or sliding down a balustrade on to a low newel post.

The operation in all cases of injured outlet should be performed as soon as possible after the injury; all other operations at a later date act only as more or less efficient substitutes.

Recent obstetrical injuries at the vaginal outlet may, for practical purposes, be classified under three heads:

1. External superficial tear.
2. Internal, and combined external and internal tear.
3. Complete tear of the recto-vaginal septum.

Recent External Superficial Tear.—The simplest form of tear begins at the fourchette, extends backward through the skin in the median line, and involves the superficial wedge of lax tissue between the fourchette and the rectum; it may extend up into the vagina as far as the posterior column. This form of injury is the commonest and relatively the least important; it does not in any case affect the supporting structures at the vaginal outlet.

The only purpose of an operation for its relief is to avoid healing by granulation and the possible formation of a tender scar.

Operation.—In its slightest forms, the external tear needs no further attention than strict cleanliness throughout the convalescence.

A deeper injury, with a base 2 to 3 cm. (¾ to 1¼ inches) in length, may be sutured immediately after delivery, or on the following day, when the patient should be brought across the bed under a good light, with the legs flexed on the abdomen and held by an assistant or by a leg holder.

The necessary instruments are a needle holder, medium-sized curved needles, and catgut and silkworm-gut sutures. These instruments should be close at hand on a sterilized towel. The hands of the operator should be carefully washed immediately before operating. The labia are now held apart with the first and second fingers of the left hand, exposing a torn triangular surface on either side posteriorly. A needle, provided with a carrier threaded with a catgut suture, is introduced in the sound tissue near the upper angle of the tear from ½ to ¾ of 1 cm. from its margin, brought out at the base of the wound, and reëntered, to emerge on the mucous surface opposite the point of entrance. A similar suture is placed about a centimeter below this. When both these sutures are tied the wound is closed down to a shallow pit on the skin surface, where two or three superficial sutures may be needed to complete the approximation.

The wound should be protected afterwards with iodoform and boric-acid powder.

Recent Internal Tear, and Combined External and Internal Tear.—Another common form of injury sustained in parturition is a slit in the mucosa, which may extend from the fourchette, or from the hymen, for 4 or 5 cm. up the vagina into one of its sulci. In another form the tear is forked and extends into both sulci. This injury is often caused by the head of the child starting a tear within the vagina, which is enlarged by the shoulder as it follows, plowing its way down between the levator fibers and their rectal attachments on one or both sides. If this tear happens to be continued forward, it becomes associated with the external tear and forms a combined external and internal tear.

Neglect of this injury results at a later date in the serious disability which I describe as a relaxed vaginal outlet. The fact that this lesion within the vagina was not looked for by our older practitioners has induced many of them to assert that lacerations never occurred in their obstetrical practice. Teachers of obstetrics can not lay too much stress upon the necessity of a proper examination after labor and proper attention to this neglected form of primary injury.

Immediately after the birth, if the labia are separated and the posterior vaginal wall inspected under a good light, the ragged, bleeding surface of the tear stands out in marked contrast with the smooth vaginal wall, although both alike are uniformly deeply congested.

The Operation.—The lacerated surfaces must be repaired at once, or on the day following delivery, for a few sutures skillfully applied at this time will accomplish the work of many more at a later date.

The patient should be placed as described in the operation for superficial external tear, resting upon a perineal drainage cushion. The use of an anesthetic, advisable if she is nervous, can usually be dispensed with if the operator is deft and can work quickly.

The following instruments are required: Needle holder, medium-sized curved needles threaded with carriers, 6 strands of silkworm gut, catgut sutures, a dozen intermediate silk sutures, a pair of scissors, and a Sims speculum or flat retractor.

It is important to secure the utmost approximation of wound surfaces by sutures placed within the vagina.

The upper angle of the wound is exposed by elevating the anterior wall of the vagina with the speculum or retractor. If the field of operation is obscured by blood, a temporary pack should be placed within the vagina above the wound. The first suture is introduced close to the upper angle of the tear, the next about 1 cm. below this, and so on down to the skin surface. The needle enters from 5 to 10 mm. ($\frac{1}{5}$ to $\frac{2}{5}$ of an inch) from the margin of the wound, according to the character of the tissue, and farther if there is much contusion; it emerges at the bottom of the wound, toward the operator, and, reëntering close by, is brought out again at a point on the vaginal mucosa corresponding to the point of entrance. A second suture is introduced a centimeter below this, with its loop directed toward the operator, and so on until the wound is closed. If an external tear is associated with the internal, as is usually the case, the opening remaining on the skin surface is now reduced to a shallow pit, and so readily approximated by a few additional superficial sutures. Each suture is best tied as introduced. Silkworm gut softened in warm water is the best suture material for the operation. These sutures may be left in the vagina for several weeks.

I mention but to condemn, the practice of closing this form of tear by sutures passed altogether on the skin surface in a wide sweeping curve beneath the lacerated tissues, leaving the important portion within the vagina ununited, for by this means a pocket is left in the posterior vaginal wall which accumulates secretions, defeating union, or even burrowing through the perineum and leaving a fistula. I have often found good broad union of the skin surface accompanied by a relaxed outlet or even prolapse.

After Treatment.—It is unnecessary to keep the knees bound after the patient has returned to consciousness, if an anesthetic has been used, and there is no objection to her making gentle movements, turning carefully from side to side in bed, elevating the knees, etc.

The use of the catheter should be avoided if possible, and, if necessary at all, should be continued for a few days only after the operation. The bowels should be opened within two days afterwards; straining efforts during defecation must be avoided.

The sutures may be removed in from eight to ten days after the operation, when the union will be found to be firm.

The patient should stay in bed from twelve days to two weeks after an operation, and for four weeks more she should go about with care, and do no hard work or lifting.

Recent Complete Rupture of the Recto-vaginal Septum.—This laceration begins at the fourchette and extends through the skin perineum in the median line, and through the sphincter ani for a variable distance up the recto-vaginal septum. The tear into the rectum forms a serious complication, destroying the function of the sphincter muscle and causing incontinence of feces and flatus. By this accident a sensitive patient is cut off from the company of her nearest friends, and compelled to live in a state of isolation. Strange, however, as it may seem, if the operation is not performed at once, the patient may carry her mal[illegible]s without seeking the relief so readily afforded.

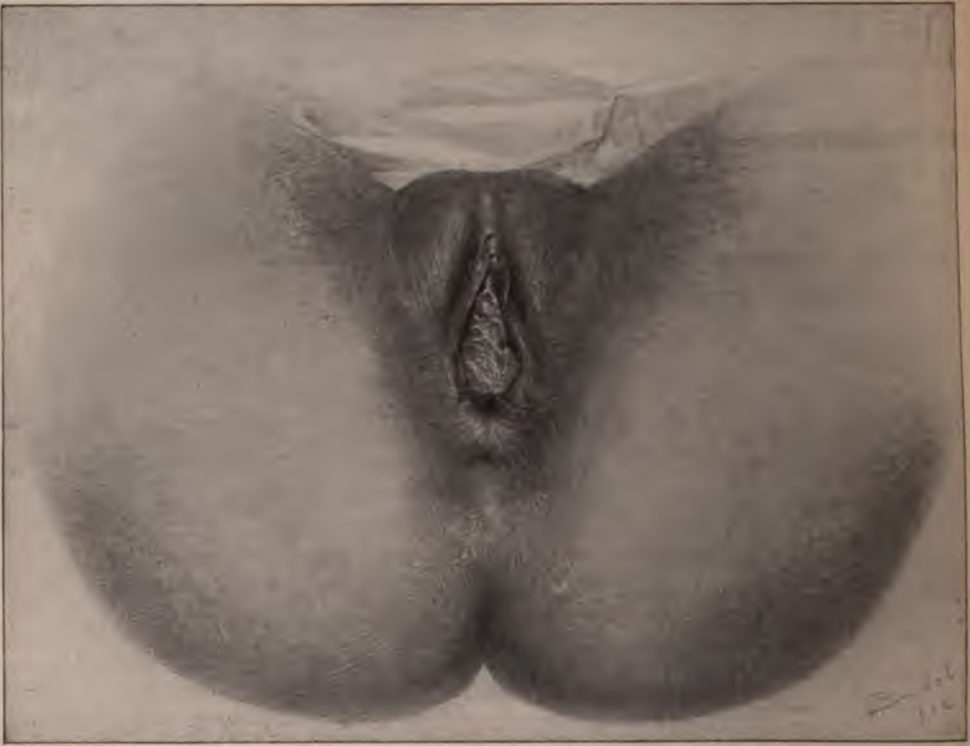


FIG. 148.—COMPLETE TEAR OF THE RECTO-VAGINAL SEPTUM, SHOWING THE CHARACTERISTIC PENTAGONAL FORM.

The opening is filled up with the anterior vaginal wall. At each end of the horizontal bar of the pentagon and below, slight depressions, indicating the sphincter pits, are seen.

ration.—An immediate operation is imperative. The parts should bly exposed, as described for the last operation, and under anesthesia, atient can not be perfectly controlled without it. The instruments re- re, a needle hold- rs, curved needles, gut and silkworm res. The first step restoration is the of the rent in the which is effected rupted fine silk or worm gut sutures rectal surface, at er end of the tear. uture pierces the of the mucosa and on the septum 4 m. ($\frac{1}{8}$ to $\frac{1}{4}$ inch) e edge, to enter um on the opposite ning out again on osa. The remain- res are passed in ner, radiating out e skin surface and g the ruptured r ends. The lower alone are not suffi- insure the sphinc- n without the ad- f a silkworm gut ntering on the skin emerging well be- ends of the rup- uscle and travers- septum, associated other suture simi- ced passing direct- ugh the sphincter

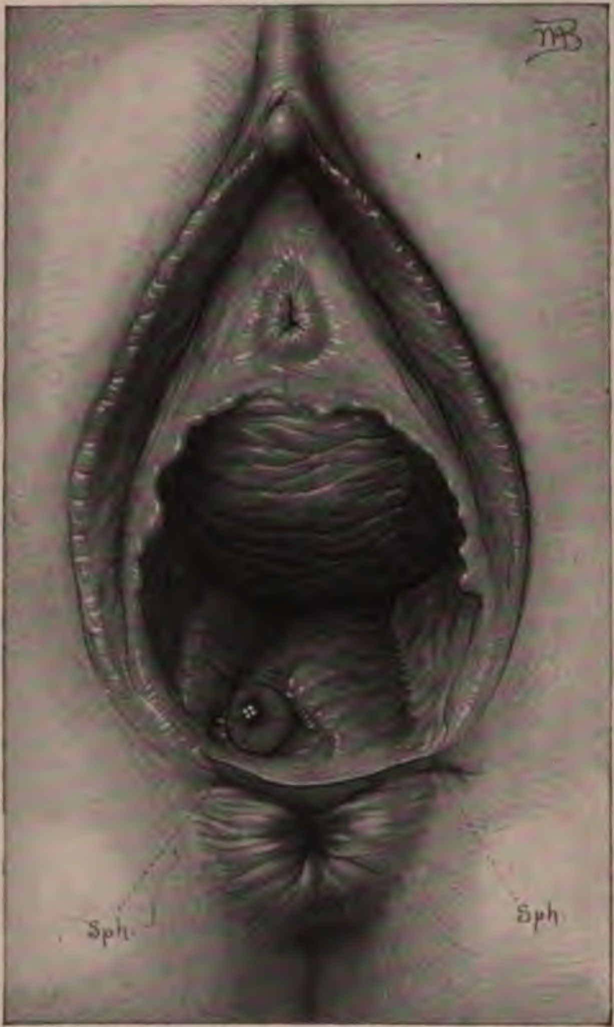


FIG. 149.—COMPLETE TEAR OF THE PERINEUM, WITH WELL-DEFINED SPHINCTER PITS AND RETRACTION AND THICKENING OF THE MUSCLE, WITH A DEEP DIMPLE BEHIND IT.

A vaginal cyst, due to inclusion of the vaginal mucosa in the healing process, is seen in the right sulcus in the scar area. Oper. FEB. 6, 1896.

The tear, now presenting the appearance of the form just described, is y interrupted silkworm gut sutures, for the most part placed within the Each suture is tied as passed, and a few superficial catgut sutures are etween them, to insure perfect approximation. This operation, when y performed, is always successful, if a puerperal sepsis does not interfere.

The bowels should be moved on the third day, without straining, and opened every second day afterwards. Under no circumstances should they be allowed to become constipated.

It is important that the patient should remain at least two weeks in bed. The external sutures should be removed on the eighth day, and the internal a week or two later.

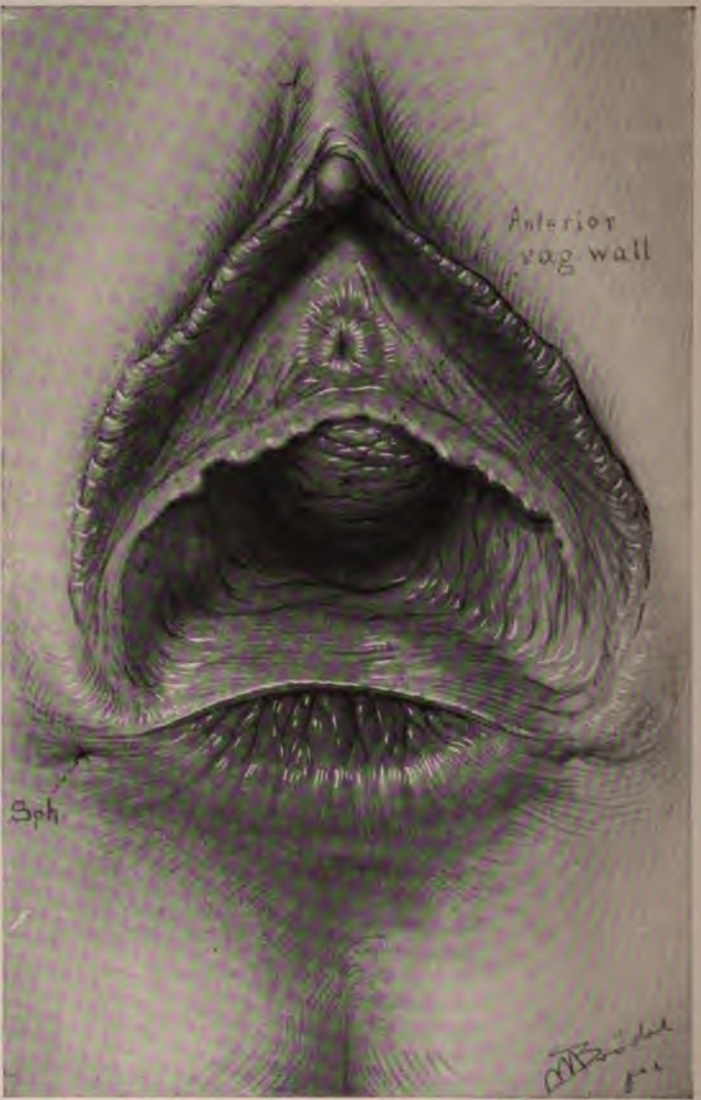


FIG. 150.—RUPTURE OF THE RECTO-VAGINAL SEPTUM, ORIGINALLY EXTENDING HIGH UP ALONG THE POSTERIOR VAGINAL WALL, BUT NOW PULLED DOWN BY THE CONTRACTIONS OF THE SPHINCTER INTO A SHALLOW ARC WITH EXTREME SEPARATION OF THE SPHINCTER ENDS. JUNE 21, 1897.

The Intermediate Operation for Injuries to the Outlet.—The intermediate period begins from five or six days and extends to two or three weeks after labor, while the unrepaired perineal wound is undergoing granulation and cicatrization. The parts at the bottom of the wound, naturally in close juxtaposition, often unite by first intention, while the remaining area is engaged in throwing off sloughing particles, granulating, and cicatrizing. In a few days small pink granulations are visible over the wound area, while the marginal epithelium as a fine white line invades it on all sides, contracting the wound from day to day. The granulating surface and the adjacent area is rigid and flushed by the new vascularization. The intermediate period, although not often selected as a time for operative interference, on account of prolonging the detention in bed, is not altogether unsatisfactory, for a well-performed operation will be almost surely followed by a good result.

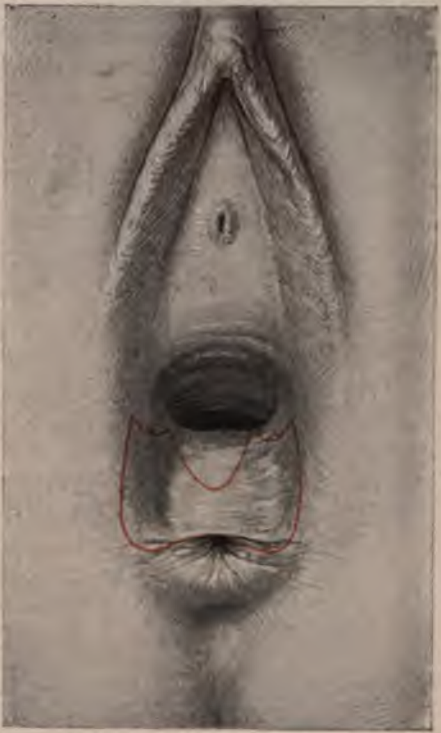


FIG. 151.—COMPLETE TEAR OF THE RECTO-VAGINAL SEPTUM.

The sphincter pits are seen below on both sides of the rectal orifice, the shortened sphincter muscle is much thickened, and there is a characteristic pit just below it. The red line incloses the area to be denuded; it must not be forgotten that the triangles seen extending up into the vagina are greatly foreshortened.

The wound is best exposed by placing the patient on a table, with flexed thighs, under a good light. Local anesthesia by means of cocain will, as a rule, be sufficient. This is secured either by saturating a pledget of absorbent cotton with a 4 per cent solution, applying it for ten minutes to the wound and surrounding tissue, or by injecting a few minims around the margin of the wound. With a sharp scalpel or spoon curette, the operator vigorously scrapes off the granulations, using also scissors and forceps as needed to effect the denudation. The peculiarity of the tissue will be found to be its friability, which makes it difficult to denude evenly in the usual way with scissors and forceps. The denudation must everywhere extend down into the sound tissue below. If some time has elapsed since the injury, it will be necessary in denuding to allow for considerable contraction of the wound. In this case strips of adjacent mucous membrane must also be removed.

The sutures should then be passed as described in the repair of recent injuries, according to the character of the tear, whether external superficial, internal, or combined internal and external. It is important to avoid introducing the sutures too close to the edge of the wound, in order to guard against the danger of their working through and becoming loose. The after treatment is the same as has been described in the previous section.

If the injury to the vaginal outlet has not been repaired during the puerperal period, one of the two following conditions will be found at a later date: complete rupture of the recto-vaginal septum, or relaxed vaginal outlet.

Old Complete Rupture of the Recto-vaginal Septum.—In from four to six weeks after labor the extensive lacerated surfaces of a ruptured recto-vaginal septum contract down to a branching scar, forming a sharp ridge across the bowel, below which a few red folds of everted rectal mucosa project (looking like hemorrhoids and sometimes mistaken for them). In the absence of the perineum, rectum and vagina have a common outlet, or cloaca, characteristically pentagonal or triangular in outline. Notwithstanding the absence of the perineum, prolapse of the vagina and uterus but rarely occurs. This fact is irreconcilable with the view commonly held that the function of the perineum is to plug the pelvic outlet like a cork. The correct explanation is to be sought in the different locations of the tear; in most cases it extends up the median line, and only branches superficially into the sulci, leaving the lower fibers of

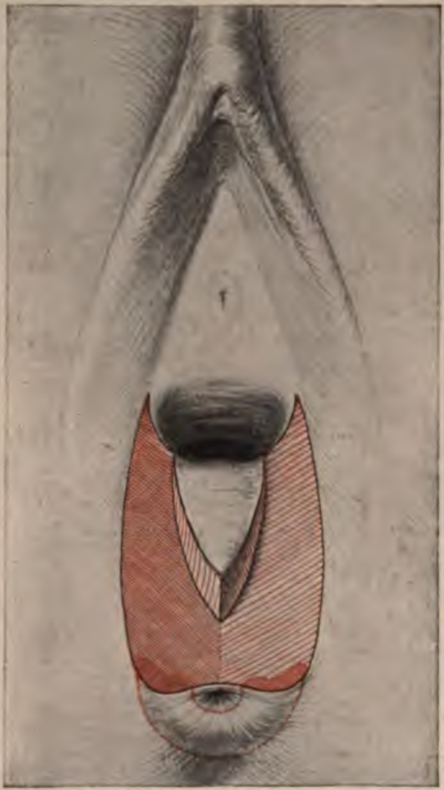


FIG. 152.—COMPLETE TEAR OF THE RECTO-VAGINAL SEPTUM. DENUDATION COMPLETED.

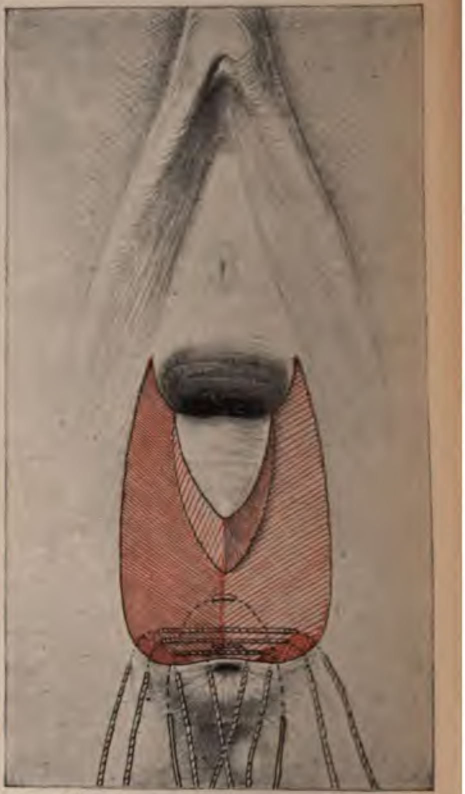


FIG. 153.—COMPLETE TEAR OF THE RECTO-VAGINAL SEPTUM.

Rectal sutures introduced, but not tied. Note the position of the silkworm gut tension suture introduced well behind the sphincter ends and passing up through the septum.

the levator ani muscle uninjured. When, in rare instances, the rupture passes through the perineum centrally and also extends deeply into one or both sulci, prolapse may occur.

The sphincter ani muscle in cases of complete tear will vary in form, in different cases, from a simple broken circle, with its ends still bound together, all the way to a shallow arc, in which case the muscle is short and thick with a deep dimple in the skin behind it. A smooth glazed depression, at times puckered or pitted, at the lower angle of the perineal scar, frequently serves as the sphincter landmark. A straight sphincter is the result of frequent contractions pulling down the angle of the tear so that ultimately a deep tear comes to look like a superficial one. Thus the extent of separation of the ends of the muscle becomes a measure of the depth of the original tear. It is sometimes difficult to identify the sphincter ends upon simple inspection, but by pulling on or pinching the muscle so as to stimulate a contraction, the position of the ends may always be discovered. It is important not to be misled,

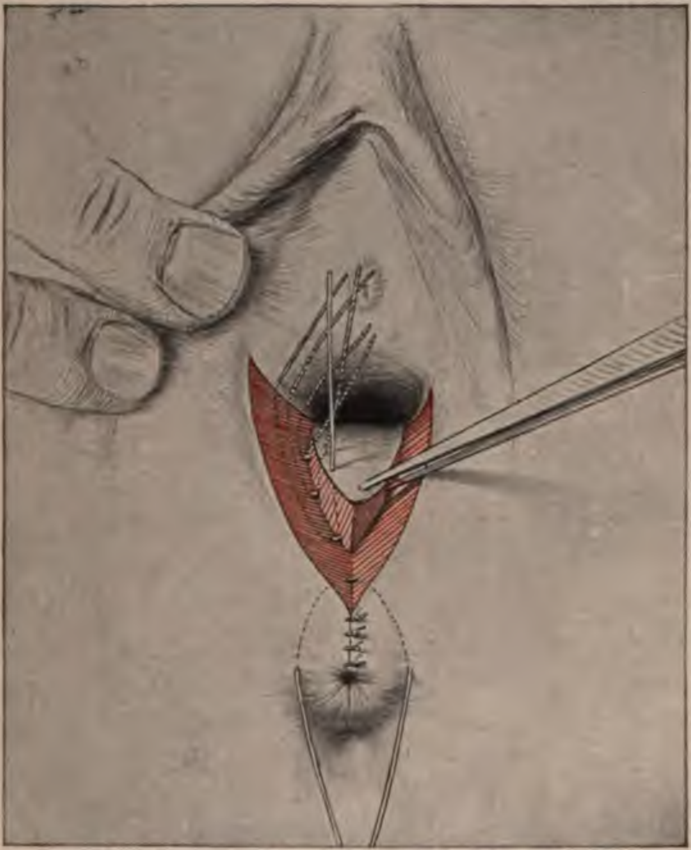


FIG. 154.—COMPLETE TEAR OF THE RECTO-VAGINAL SEPTUM.

The rectal sutures all tied except the silkworm gut tension suture. The sutures are introduced but not tied in the right vaginal sulcus, one of silkworm gut and two of catgut above it.

by the ability of the patient to retain feces, into the error of thinking the tear can not be complete, for where the original rent is shallow and the cicatrix in the angle binds the ends firmly together, the sphincter will often contract efficiently up to this point. A similar result is, in fact, all we can hope to attain by the best plastic operation.

Operation.—Women with complete rupture of the septum sometimes have a chronic diarrhea. When this is the case the only preparation necessary is an injection high into the bowel a few hours before the operation, clearing out all fecal matter. In other cases a free purgation must be secured the night before operation, followed by an enema in the morning. Carbolized and mercurial solutions, if used at all in other cases, must never be used for irrigation here, on account of the danger of fatal poisoning from absorption through the bowel. To prevent discharges from contaminating the field, one or two pledgets of iodoform gauze wrung out in warm water are pushed up into the lower bowel, to be removed when the operation is completed. The instruments necessary

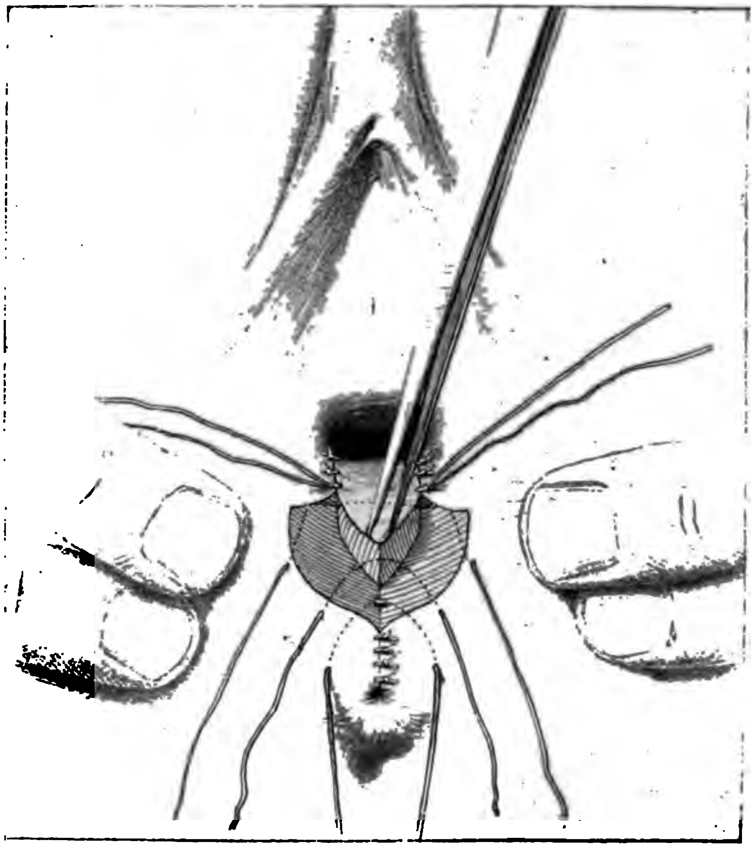


FIG. 155.—COMPLETE TEAR OF THE RECTO-VAGINAL SEPTUM.
Rectal and vaginal sutures all introduced and tied, and the perineal sutures in place, but not yet tied.

are scalpel, dissecting forceps, Emmet's left-curved scissors, needle holder, curved needles, and catgut and silkworm gut sutures. The area to be denuded must be outlined with the scalpel, which follows the direction of the scar tissue in a general way, greatly exaggerating its outlines; the cardinal principle in the denudation is to reproduce as nearly as possible the original injury.

The first incision splits the septum and includes the sphincter ends, from which a line is continued up under the pubic arch on either side; thence it goes down into each vaginal sulcus and back again, meeting in front of the posterior column, 1 to 2 cm. ($\frac{2}{5}$ to $\frac{1}{2}$ inch) above the first incision in the septum. All of the tissue included within the outline is now removed. Begin at one of the sphincter ends, catching it up with tissue forceps and cutting it free with curved scissors. Continue the denudation around the sharp edge of the septum to the opposite end of the sphincter, which is denuded in the same way, taking care to remove all scar tissue. A second strip above and parallel to this is next cut off, a third, and so on, continuing the denudation up into the vagina until the whole area within the outline has been removed. It is important to

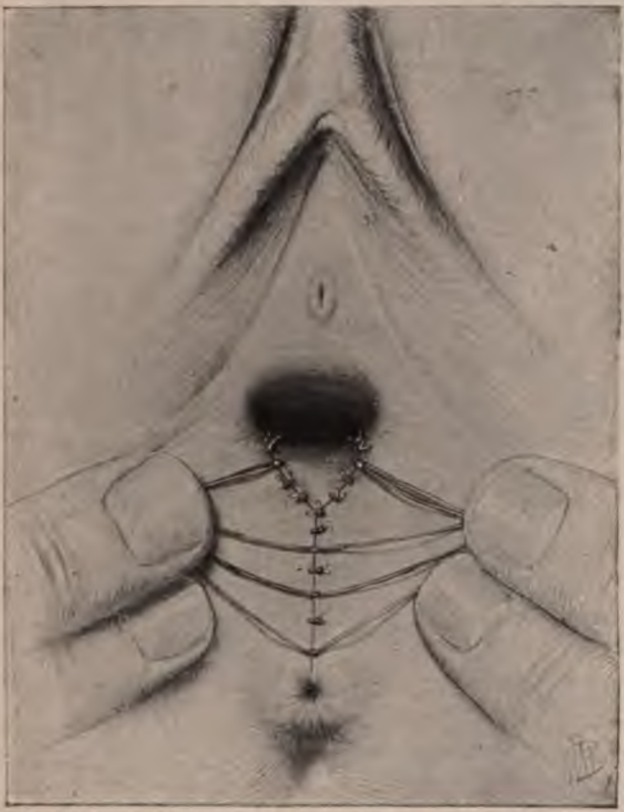


FIG. 156.—COMPLETE TEAR OF THE RECTO-VAGINAL SEPTUM.

All three sets of sutures introduced and tied, the catgut suture cut off and the silkworm gut left long. The outlet is pulled open a little in order to show the inside suture.

bear in mind that the denudation within the vagina must extend 1 cm. or more ($\frac{1}{2}$ inch or so) above the angle of the tear in order to avoid the tendency to form a recto-vaginal fistula at this point. Silkworm gut and catgut sutures are best adapted to the approximation of the denuded surfaces. Half-deep sutures of catgut are preferable for closing the rectal side of the tear, and for securing accurate approximation between the silkworm gut sutures, which are used at wider intervals. The complication of the torn bowel is first disposed of by a series of interrupted rectal sutures, commencing at the upper angle of the tear, entering each suture at the margin of the rectal mucosa, and emerging on the wound surface 4 to 5 mm. ($\frac{1}{10}$ to $\frac{2}{5}$ inch) distant, reëntering on the opposite side and coming out again on the margin of the mucosa at a point corresponding to that of entrance. This suture may be tied at once and dropped into the rectum, and a little less than a half centimeter ($\frac{1}{5}$ inch) below this another suture passed in like manner, tied, and dropped, and so on until the whole of the rectal rent has been obliterated down to the sphincter. One of the most important points in the operation now is to secure an accurate approxi-

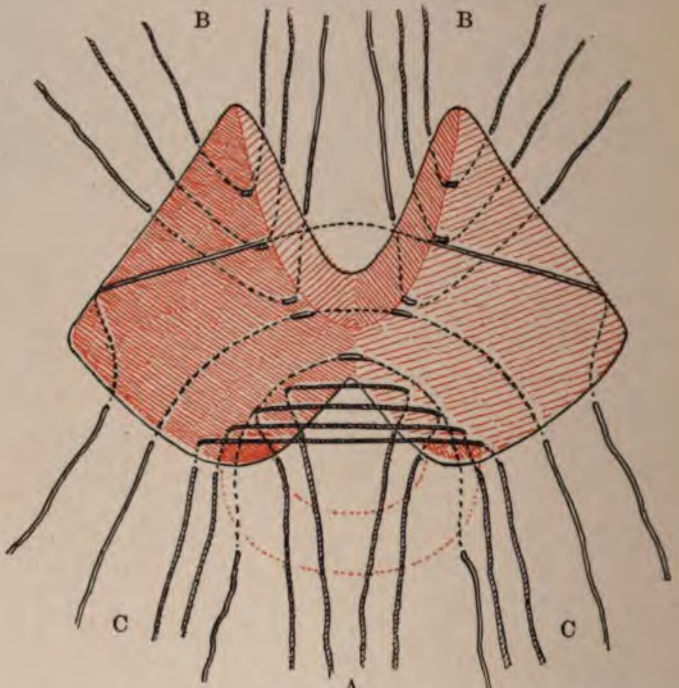


FIG. 157.—SCHEME OF THE OPERATION FOR COMPLETE TEAR OF THE RECTO-VAGINAL SEPTUM LAID ON A FLAT SURFACE.

The torn sphincter muscle is indicated by dotted red lines cross-hatched at each end. The deep indentation on the under side of the figure represents the rectal side of the tear, and the two red triangles above, one on each side, represent the denudations extending up into the vaginal sulci. The sutures are passed first on the rectal side, A, radiating out into the perineum, then in the vaginal sulci, B, and finally on the perineal side, C. The cross-marked sutures are of catgut and the plain ones of silkworm gut. Note especially the silkworm gut sutures passed in behind the sphincter ends and up into the septum. It is best to use fine silk in the rectum.

mation of the sphincter ends by two or three sutures radiating from the rectal out on to the skin surface. The contractions of the sphincter render it necessary to assist these sutures with one of silkworm gut introduced well behind to the denuded ends and passing up through the septum. When this has been done the rectal rent is repaired, the wound is reduced from a complicated one involving three surfaces—rectum, skin, and vagina—to a simpler wound involving vagina and skin perineum.

The next step is the repair of the vaginal wound by a silkworm gut suture in either sulcus, reaching down to the series of rectal sutures, at the bottom of the wound. The loop of the suture should lie in a plane nearer to the operator than its points of exit and entrance, so as to lift up the tissues at the bottom of the wound when it is tied. Superficial and half-deep catgut sutures complete the union within.

There still remains an opening on the skin surface, which is readily brought together by a silkworm gut suture, aided by a few superficial or half-deep catgut sutures.

An imperfect, improper perineal union, without union of the sphincter, is shown in Fig. 158. An operation of this kind must be done over again, in order to obtain better union of the tissues on the vaginal side, to get rid of the unsightly perineal scar tissue, and to unite the divergent sphincter ends.

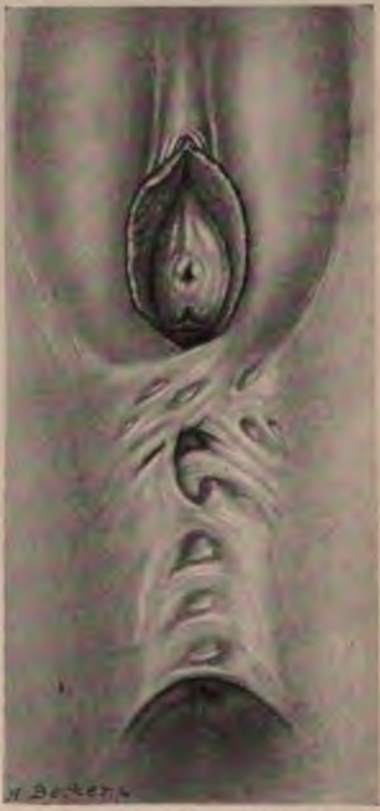


FIG. 158.—SHOWS A BADLY CLOSED PERINEUM WITH EXCESSIVE SCAR TISSUE IN WHICH NO UNION OF THE SPHINCTER ENDS HAS BEEN SECURED. R., OCT. 12, 1901.

The Use of a Vaginal Flap with the Direct Suture of the Sphincter Muscle.—The following method of closing a complete tear is a more ideal procedure than that just described, both in its immediate and its remote results, but it is more delicate, and more difficult of performance. It aims at two improvements upon the classical operation: The first is the turning down of an apron of tissue from the side of a torn septum hinged at the neck, so as to avoid passing any sutures on the rectal surface; the second is the dissection and liberation of the ends of the sphincter muscle, so as to bring them into direct apposition by suture. The steps of the operation are, briefly, as follows:

Fig. 159 shows a complete tear; laterally are seen the pits of the torn sphincter. The line A–B marks the transverse incision separating the tissues below this line, which are to be liberated and turned down so as to form the

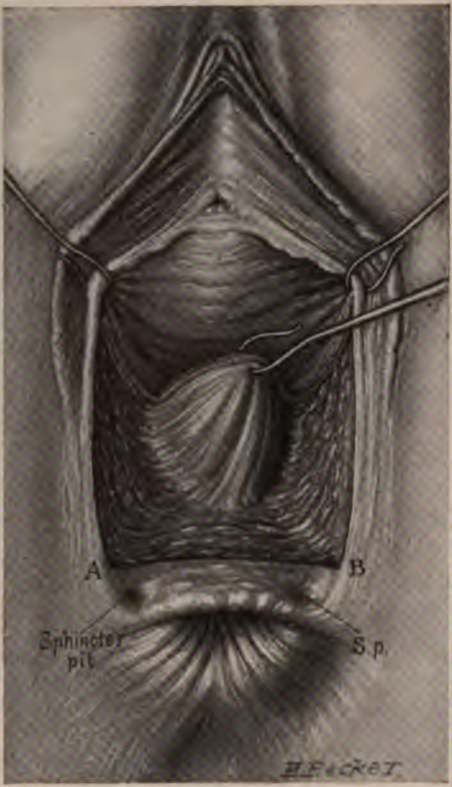


Fig. 159.—The Denudation in a Case of Complete Tear in which the Tissue below the Line *A*, *B*, has been left so as to Form an Apron which is to be Dissected Loose and Turned Down in the Manner Shown in the Next Figure.

apron, instead of being cut away, from the tissues above this line, which are to be denuded as usual. The line at A and B may be extended down parallel to the bowel as shown in Fig. 160, in order to facilitate the dissection of the sphincter ends. With practice in finding the sphincter, however, this is not usually necessary.

The Apron.—In liberating the apron, or flap, care must be taken not to make it too thin on the vaginal side in order to avoid possible sloughing, and the operator must also be on his guard against cutting too close to the rectum. A fleshy, vascular flap is desirable. After turning down the flap the tissues in the sphincter pit are picked up with dissecting forceps and the operator cuts skillfully into the tissues around the elevated point with a pair of curved scissors, first on one side and then on the other, so as to expose and draw out the sphincter ends. When this is done on both sides the ends may be united with the interrupted, buried, catgut sutures as shown in Fig. 161. The denudation on the vaginal

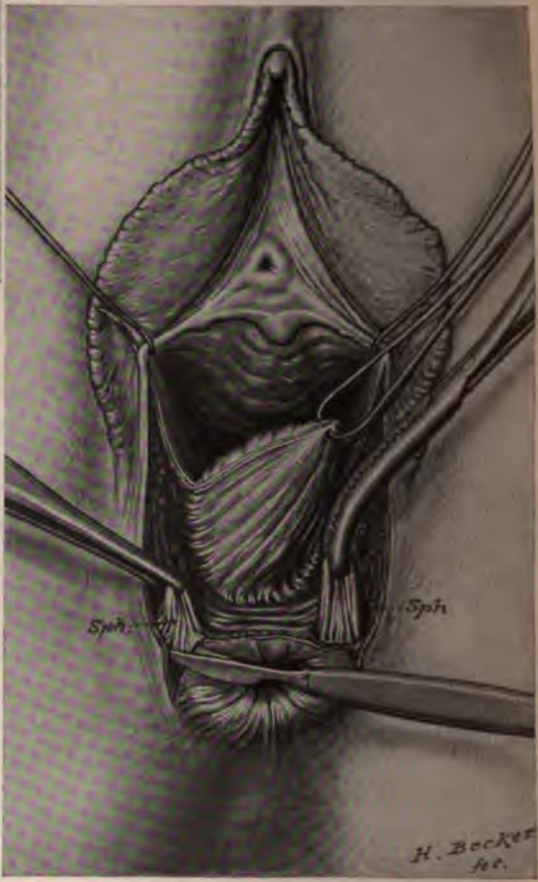


Fig. 160.—Two Lateral Incisions and the Dissection of the Apron seen in Fig. 159, serve to lay bare the Sphincter Area. The Muscle is then Picked Up and Dissected Out as shown.

side is similar to that described in the operation for relaxed vaginal orifice, and the suturing also is done in the manner shown in Figs. 174, 175, and 176.

After closure of the sphincter, and after the vaginal sutures have been placed and tied, the wound presents the form shown in Fig. 162. The next important step is to pass a silkworm gut suture through the sphincter, extending down to the bottom of the denuded septum. The rest of the perineal wound is then closed with silkworm gut and catgut. Finally, the sides of the apron are brought together with delicate silk sutures as shown in Fig. 163. It will be seen that in this way all the suturing is done outside the bowel. The formation of this little apron was first suggested by Dr. C. Warren, of Boston. Sloughing of the apron, owing to anemia, sometimes occurs, but, as a rule, does no harm, the necrotic tissue being only superficial. The direct suture of the sphincter ends has been done by Laconte, by Baldy, by Leopold, and by Dickinson.

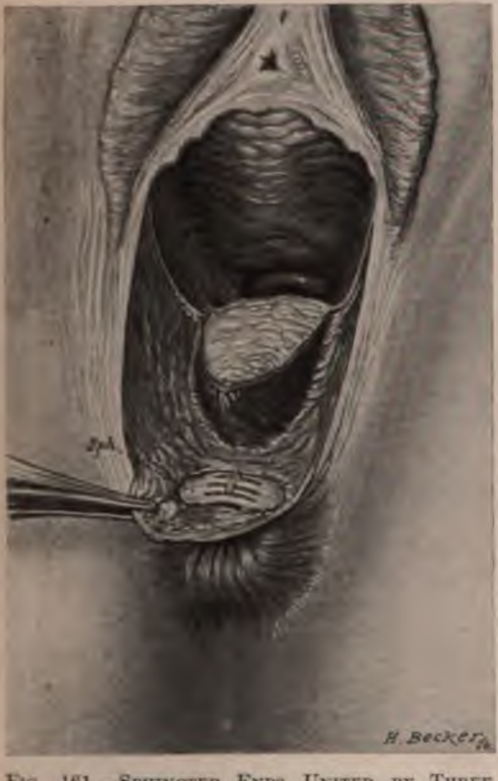


FIG. 161.—SPHINCTER ENDS UNITED BY THREE BURIED CATGUT SUTURES. THE APRON WHICH PROTECTS THE WOUND FROM THE BOWEL IS HELD BY THE FORCEPS.

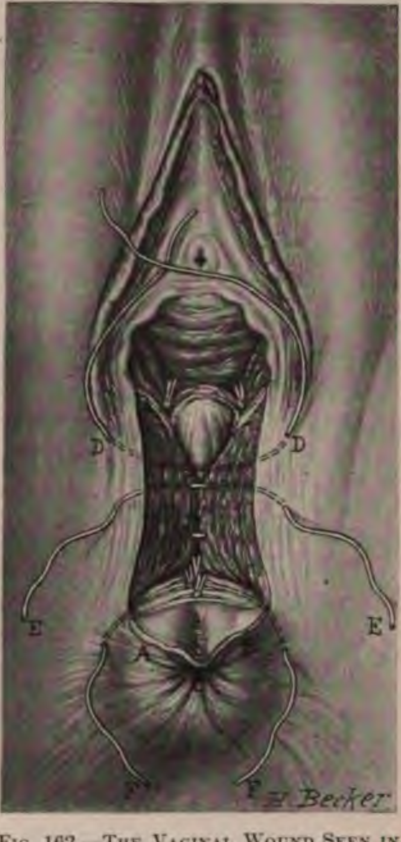


FIG. 162.—THE VAGINAL WOUND SEEN IN FIG. 161 IS CLOSED AS IN OTHER PERINEAL OPERATIONS.

The perineum is about to be closed by deep interrupted sutures represented by *D* and *E*. The sphincter muscle which has been united by buried catgut sutures is held firmly splinted by the silkworm gut suture *F*, *F*. Instead of going round the muscle, it is best to make this suture transfix it on both sides, entering and emerging near the points *A* and *B*.

Liberation of the Rectum in Complete Tear of the Septum.—A skillful plan of treating deep complete tears has been devised by Dr. George H. Noble, of Atlanta, Ga. (*Trans. Amer. Gyn. Soc.*, 1902, vol. 27, p. 357), which consists in splitting the recto-vaginal septum, detaching the rectum from the vagina, and drawing down the anterior rectal wall through and external to the anus, in this way obviating the necessity of passing sutures on the rectal side of the tent, in the method just described.

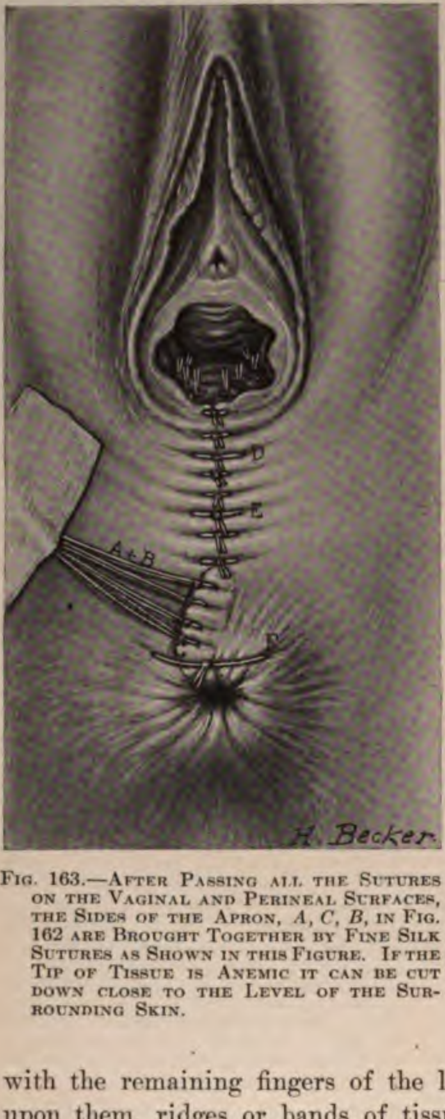


FIG. 163.—AFTER PASSING ALL THE SUTURES ON THE VAGINAL AND PERINEAL SURFACES, THE SIDES OF THE APRON, *A*, *C*, *B*, IN FIG. 162 ARE BROUGHT TOGETHER BY FINE SILK SUTURES AS SHOWN IN THIS FIGURE. IF THE TIP OF TISSUE IS ANEMIC IT CAN BE CUT DOWN CLOSE TO THE LEVEL OF THE SURROUNDING SKIN.

"The line of incision starts on the external side of the sphincter dimple, at a point close to one end of the sphincter muscle, care being taken not to cut the skin at this point. It follows the edge of the sheath of the muscle, passing between it and the rectal mucosa, making the flap at this point as thick as possible. It then turns upward and forward to the cellular interspace of the recto-vaginal septum, splitting it in the center, and returns on the opposite side to a place corresponding to the starting point. This makes an incision similar to the ordinary flap-splitting operation, except at its extremities. The incision is best made with a pair of sharp-pointed scissors. After cutting through the cicatricial structures to the healthy tissue beneath, two pairs of light compression forceps are placed on the rectal flap some distance on either side of the center, embracing in their grasp the entire thickness of the rectal wall. The left hand should be protected with a rubber glove and the index finger passed into the rectum beyond the angle of the laceration as a guide to prevent perforation of the rectal flap. The forceps are held with the remaining fingers of the left hand, and, as slight traction is made upon them, ridges or bands of tissue will form across the line of incision; these are cut as they appear. The point of the scissors used in the dissection should be turned slightly in the direction of the vagina, that is, away from the rectum to avoid liability of perforating the latter. Unless care is observed, the tendency will be to cut the flap too thin, so as not to embrace the entire thickness of the rectum; this can be avoided by confining the incision to the cellular interspace.

"After reaching this stage of the operation there is no longer any necessity for the finger in the rectum. It should be withdrawn, the glove removed, and the hands resterilized. The torn surface of the perineum is next denuded and the excess of the vaginal flap cut away. Two kangaroo or ten day catgut sutures are inserted deeply into the perineum behind one end of the sphincter muscle, passed to the opposite side, taking up, in crossing, the thickest part of the rectal flap (about its middle portion) without penetration of the rectal mucosa, and returned to the other end of the sphincter ani, to issue at a point corresponding to the place of introduction (Emmet sutures). In exceptional cases the sphincter muscle may be very much shortened or retracted, and its ends require approximation by buried sutures to secure the best immediate results. When the Emmet sutures are tied the wound is converted into the condition of a simple perineorrhaphy, and is then completed by some method employed for incomplete tear."

Union of the Sphincter without Perineal Operation.—A case sometimes occurs in which the perineum is well restored, but the sphincter ends are still separated, and the patient has, consequently, no satisfactory control over the passage of gas and of fecal movements. Such a case is shown in Fig. 164, operated upon Dec. 8, 1897. The method of operation adopted in this as in other similar cases, was to make a horseshoe incision on the perineal surface, and turn down a flap of tissue toward the bowel, similar to the apron described

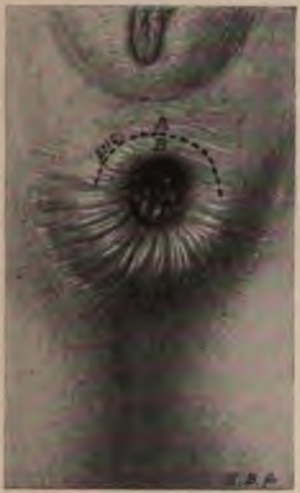


FIG. 164.—SHOWS THE INCISION IN THE PERINEUM, MADE TO EXPOSE THE SPHINCTER END IN A CASE OF COMPLETE TEAR IN WHICH THE PERINEUM HAS BEEN RESTORED WITHOUT SECURING SPHINCTER UNION.

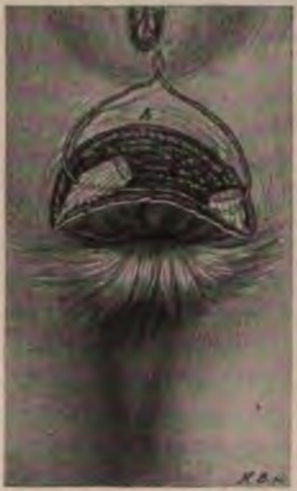


FIG. 165.—SHOWS THE SPHINCTER ENDS OBLITERATED AND UNITED BY CATGUT SUTURE.

It is best to use two or three sutures and to splint the ends in addition by a silkworm gut suture which transfixes both ends of the muscle and passes up into the septum. This is not shown in the next figure.

in the preceding section. This is done to avoid placing sutures on the side of the bowel. The ends of the incision must be carried far enough down on either side to expose the sphincter muscles, which can usually be readily felt between index finger and thumb. After liberation of the sphincter, as shown in Fig. 165, the ends are united by two or three interrupted catgut sutures. It is important at this juncture to pass a silkworm gut suture just through the skin behind the ends of the incision, transfixing the sphincter end of one side, passing up through the septum, and then passing down and out, transfixing the opposite end. Before tying this suture, the silk or catgut sutures may be placed as shown in Fig. 166. After this the silkworm gut suture may be tied tight enough to take the tension off from the buried sutures.

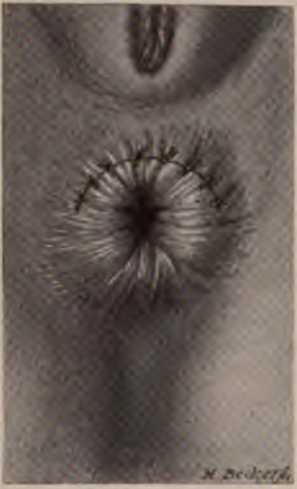


FIG. 166.—SHOWS THE SPHINCTER ENDS UNITED AND THE SKIN WOUND CLOSED.

The after treatment of these cases may be conducted in one of two ways. Either the bowels, which were well emptied before the operation, are evacuated on the third day following operation, or the evacuation is put off for eight or ten days. If the bowels are to be moved on the third day it is well to give a dose of compound licorice powder or cathartic pills on the eve of the second day in order to secure the movement the next morning. Great care must be taken to keep the parts from being soiled, and, if necessary, the perineum should be well irrigated with a boric acid solution and a fresh dressing applied. I prefer for my part keeping the bowels locked and feeding the patient for from seven to ten, or even twelve, days on nothing but albumen. The total amount of albumen given in ten days amounts to about one liter and a half. I begin by giving two teaspoonsful of albumen in water every three hours, increasing this amount on the fourth day to four teaspoonsful, on the last day, say the tenth, she receives two drachms of the compound licorice powder in the evening, followed by an oil enema in the morning. It is best to let the bowels move with the patient lying on her side to avoid straining. When albumen alone is given there are no scybala and the action is a perfectly normal one unattended by any danger or difficulty.

THE RELAXED VAGINAL OUTLET.

The name "relaxed outlet" describes a loose, gaping introitus, a condition which is more frequently observed after multiple childbirth, each successive delivery distending the orifice, until it appears like the mouth of a bag without its drawstring, as Dr. T. A. Emmet has long been in the habit of describing it. Although a frequent ailment, it is rarely recognized except under the guise of some one of its attendant and accidental features, such as "rectocele," "cystocele," or "rectocele and cystocele," or "laceration of the perineum" in varying degrees.

Clinical Appearance.—Upon inspection of such a patient, lying on the back, with the legs flexed, the cleft of the buttocks appears flattened and broad; the anus is often wide, somewhat everted, and displaced backward; the sphincter ring is clearly seen. The skin perineum is often preternaturally deep and the fourchette intact. In other cases the skin surface of the perineum is torn as far back as the sphincter ani. The intact deep perineum has long been a gynecological stumbling block, on account of the inveterate habit of physicians of estimating the functional activity and efficiency of the vaginal outlet by its depth on the skin surface; a "good perineum," signifying that the distance from fourchette to anus measures 2½ cm. (1 inch) or more, whence the faulty conclusion is drawn that the support at the vaginal outlet must likewise be "good." The fact is that in many of the worst forms of relaxation the perineum is deeper on the skin surface than before childbirth, a condition due to the overstretching of the external skin at the time the outlet was broken down.

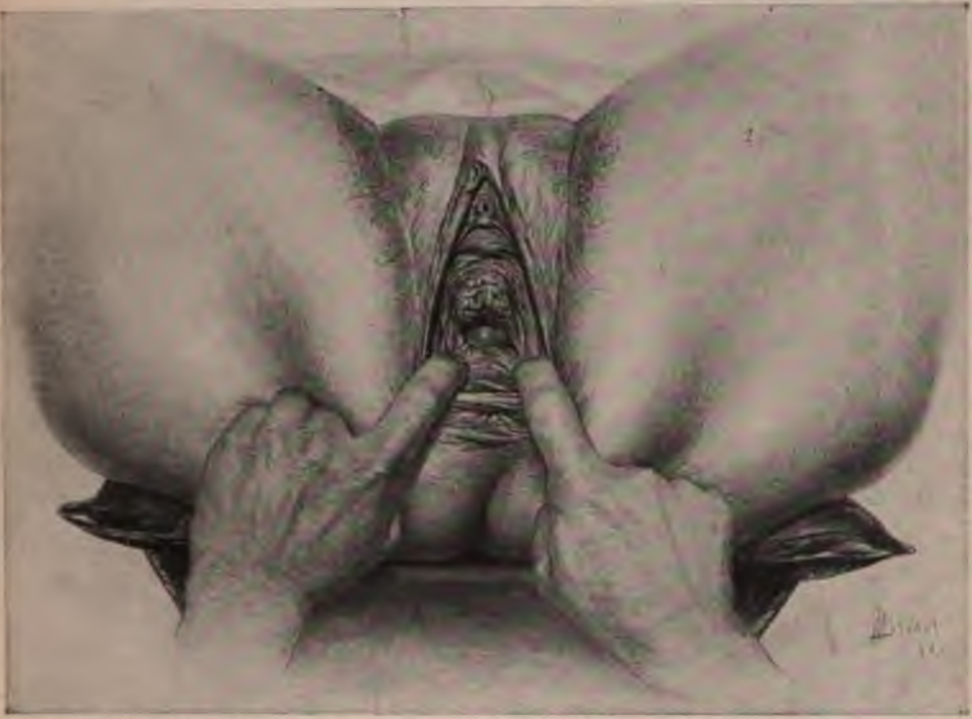


FIG. 167.—METHOD OF DEMONSTRATING A RELAXED VAGINAL OUTLET BY HOOKING THE FINGERS IN THE VAGINA ON BOTH SIDES AND PULLING OUTWARD AND BACKWARD.

The entire vagina and the cervix of the uterus are exposed by the fingers as by a speculum.

On separating the labia in a case of relaxed outlet the vaginal walls appear more or less pouting, and either the anterior or posterior walls may protrude to a marked degree. In rarer cases, lateral, anterior, and posterior walls all protrude.

The relaxed condition of the vaginal outlet may be demonstrated in a variety of ways. Upon instructing the patient to bear down, both anterior and posterior walls roll out, bringing into view a considerable portion of the lower vagina. We are thus enabled to estimate the effects of lifting, walking, or straining at stool upon such a patient. If a finger is placed upon the cervix uteri, during the act of straining it will be felt descending in the axis of the vagina toward the outlet. The descent is especially marked if the patient is

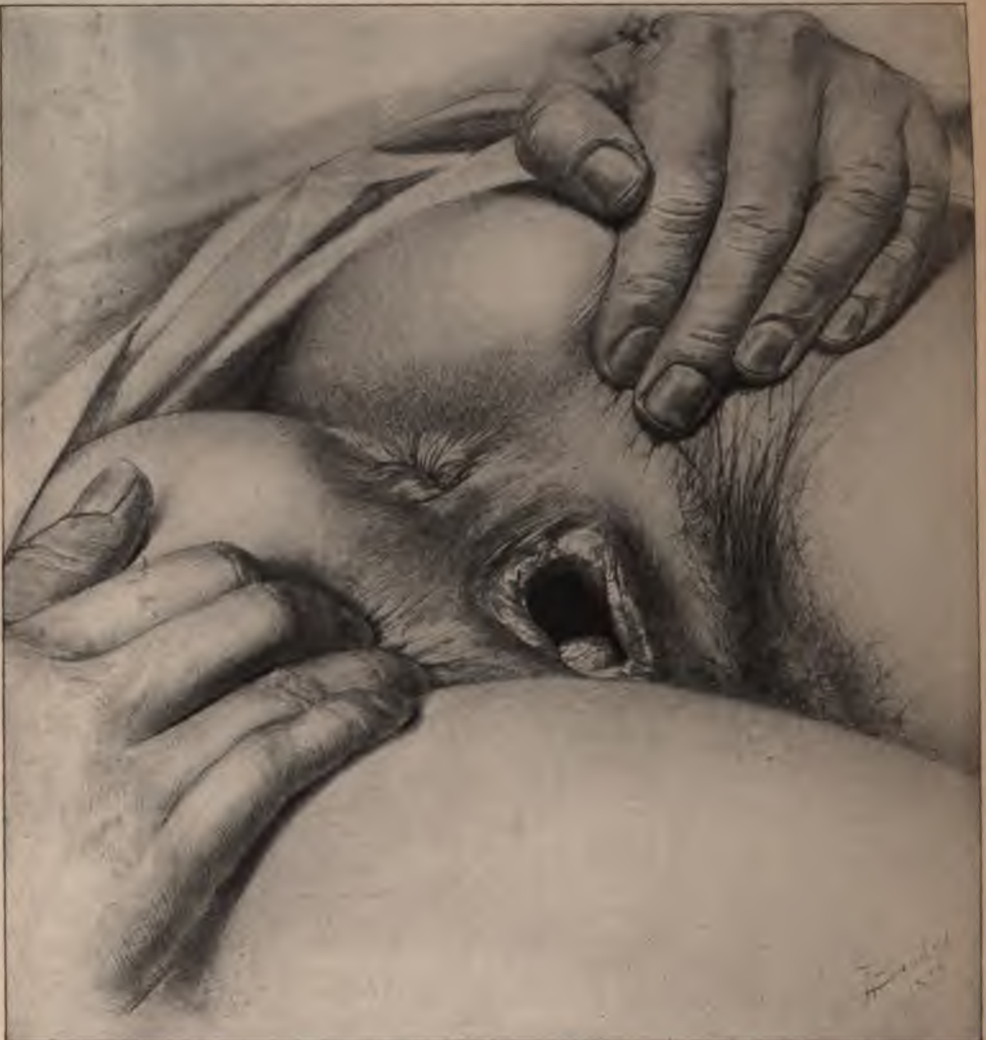


FIG. 168.—TEST FOR THE RELAXED VAGINAL OUTLET, SHOWING HOW THE POSTERIOR VAGINAL WALL DROPS WELL AWAY FROM THE ANTERIOR WALL BY SIMPLY PLACING THE PATIENT IN SIMS' POSTURE.

The external skin perineum is well preserved, but in spite of this there is a large lax, gaping orifice.

examined in the erect posture, when the surgeon will also be still better able to judge the effect of exercise upon her pelvic organs.

Upon placing the patient in the left lateral position and elevating the upper right buttock, air rushes audibly into the vagina and the posterior vaginal wall drops away from the anterior, leaving the gaping outlet as a large hole in the pelvic floor (see Fig. 168).

Palpation in the dorsal position reveals other important deviations from the normal outlet. The perineum is often but a lax, thin partition which may easily be gathered up between thumb and forefingers of both hands and lifted up over the urethra and the clitoris. Many physicians are misled by the fact that, when the patient is lying in the dorsal position, the deficiency is apparently filled out by the lax anterior and posterior vaginal walls. Touch, however, ought to demonstrate at once that the protrusions are loose, baggy tissue, incapable of affording any support. So far from doing so, they serve as danger signals, indicating a progressive descent of the vaginal walls and the uterus.

Further palpation shows that the strong lower levator fibers stretching from one pubic ramus to the other, and supporting the outlet, have disappeared; in their place, the levator fibers are found more or less parallel to the lateral walls of the vagina. In the relaxed outlet, therefore, there is both a change in the direction of the lower levator fibers and a difference in the size of the levator loop surrounding the posterior vaginal wall. The broad, powerful transverse band, from pubic ramus to pubic ramus, has been replaced by a long, sharp-edged, lax loop, whose lumen is filled up by such soft, weakly resisting structures as vaginal walls and rectum.

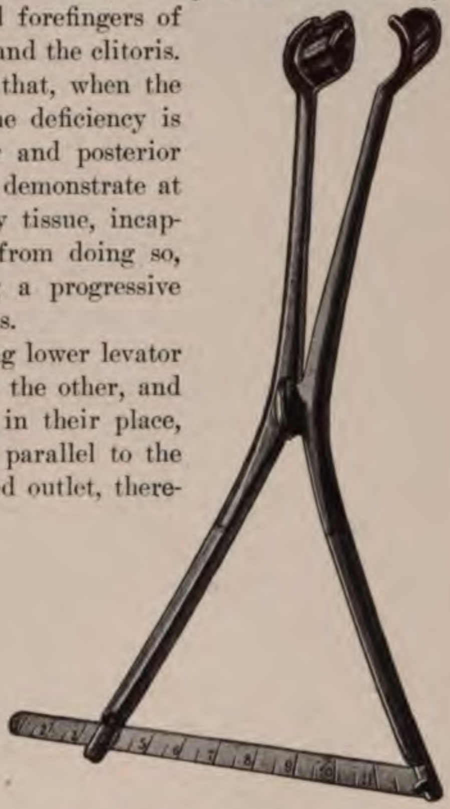


FIG. 169.—CALIBRATOR FOR MEASURING THE DEGREE OF RELAXATION OF THE VAGINAL OUTLET; GRADUATION IN CENTIMETERS.

The blades are closed and introduced just within the outlet and then opened as far as they will separate easily. The figures on the scale measure the degree of the relaxation.

The lesion is not always the same; the levator ani on one side sometimes remains intact, while its fellow of the opposite side is severed from its rectal and vaginal attachments. The difference in the direction of the fibers of the two sides is then marked, for while the intact side preserves a more or less horizontal direction, its broken-down fellow hangs parallel to the lateral vaginal wall, at which point the finger may be buried in the deep sulcus between the rectum and the levator. Again, the attachment of the fibers on one side may be nearer the outlet than the fibers of the opposite side, which lie in a different plane.

While the eversion of the relaxed outlet is often evident upon simple inspection, it may be most characteristically demonstrated by placing the thumbs on either side of the outlet behind and pushing outward and upward.

In many cases of reflex disturbances a relaxed outlet can be detected only by examination under an anesthetic, for during a conscious examination the weakened levator is under tonic contraction and more or less efficiently closes the outlet, whereby the examiner may be so far deceived as to estimate a marked relaxation as one of minor degree, or even to overlook the condition altogether. I call these cases "concealed relaxations."

It is a curious anatomical fact that the hymen is often better preserved in a relaxed than in a normal parous outlet. The explanation lies in the mechanism of parturition. In the lax outlet the distention has not been equal on all sides; rupture has occurred, and the hymen has given away in one or two directions. Thus the sequence of precipitate labor may be the curious anomaly of a greatly overstretched outlet with an overstretched hymen, torn in but one or two places.

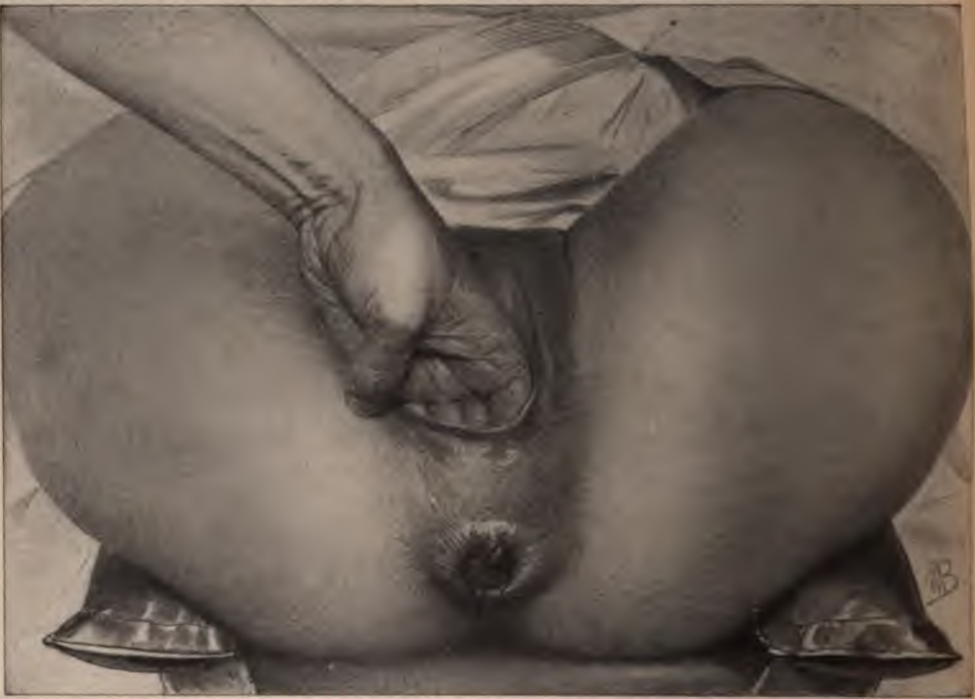


FIG. 170.—TEST OF AN EXTREME RELAXATION OF THE VAGINAL OUTLET.

Four fingers are easily introduced into the vagina and the thin pelvic floor pushed out, everting the rectum, and showing the entire absence of support.

It is a good plan always to measure and record the degree of relaxation by using a calibrator like that figured in the text (see Fig. 169). By introducing the instrument closed, when it is about the size of the index finger, and then opening it with gentle pressure until resistance is felt, the degree of relaxation is noted and read off on the graduated rod as four, six, or more centimeters.

Operation.—The rational treatment for the relaxed outlet is resection. There are in general two modes of operating—the posterior median, and the posterior bilateral exsection of the superfluous tissue, followed by suture. Since the natural outline of the vagina in cross section near the external orifice is **H**-shaped, the obvious inference is that the vaginal tissues will unite to best advantage in the limbs of the **H** that is in the sulci. This I believe is a correct inference, and I prefer, therefore, a bilaterally symmetrical operation extending up both sulci, based on the procedure of Dr. T. A. Emmet, of New York.

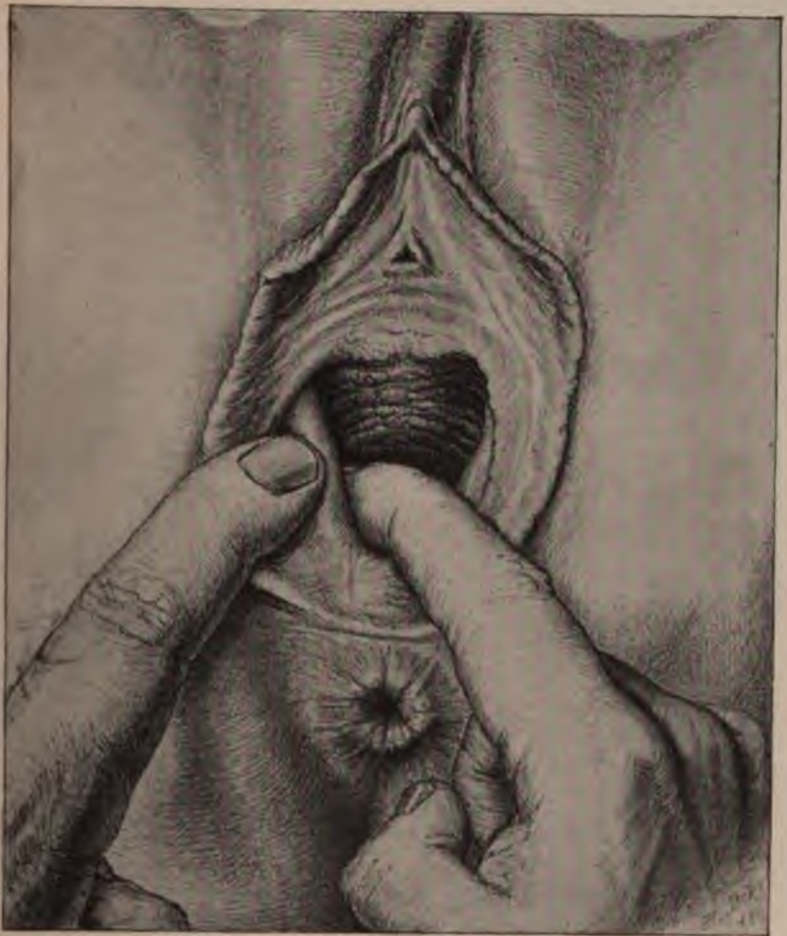


FIG. 171.—RELAXED VAGINAL OUTLET.

The fingers are demonstrating the position and the direction of the lower fibers of the levator ani muscle, which is grasped between them. The almost vertical direction of the levator loop is especially noteworthy as the most characteristic feature.

It is necessary to exaggerate slightly the effect of the operation in narrowing the vagina in order to counterbalance a slight relaxation which always follows.

The first step is to determine the limits of the denudation; this is done by means of two tenacula shaped like a shepherd's crook, fixed on either side at the junction of the hymeneal ring, or its remains, leaving sufficient tissue across the anterior vaginal wall between the tenacula to make a small outlet when the tenacula are brought together. These points mark the upper lateral limits of the resection. If they are fixed too near the urethra too much tissue will be removed and the new outlet will be too contracted; on the other hand, if they are fixed too low down, the new outlet will continue to be too large, notwithstanding the operation. The correct pattern to have in mind in resecting is the nulliparous outlet.

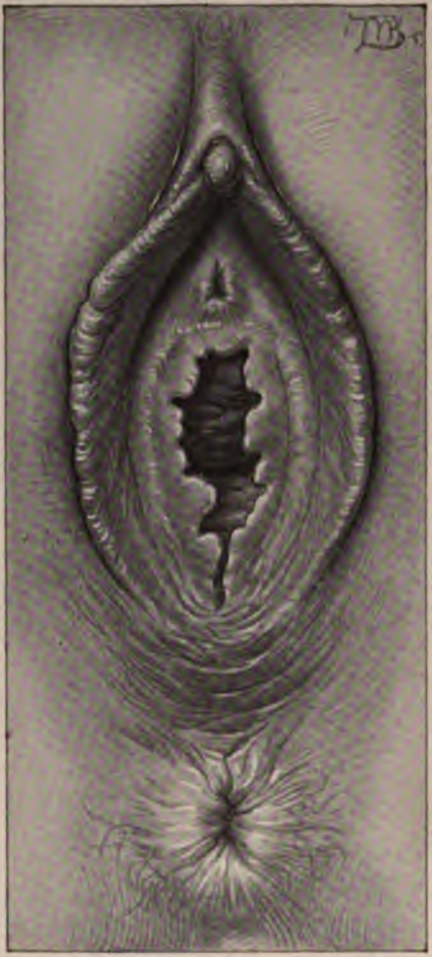


FIG. 172.—RELAXED VAGINAL OUTLET IN A VII-PARA, WITH PERFECT PRESERVATION OF THE HYMEN, EXCEPT IN THE MEDIAN LINE POSTERIORLY.

Forceps were not used in any of the labors. Operation, JUNE 1, 1897.

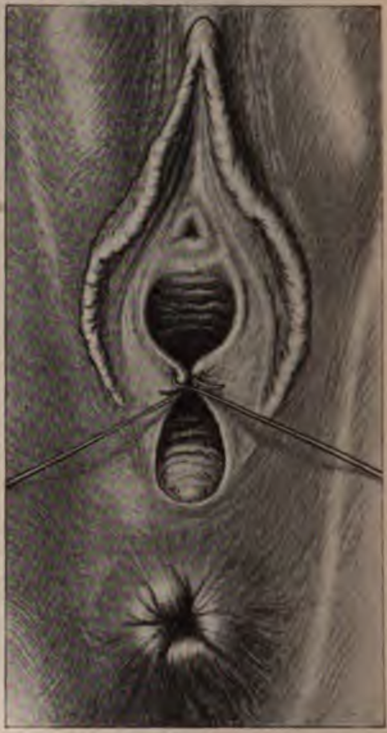


FIG. 173.—RELAXED VAGINAL OUTLET.

Shepherd's-crook tenacula fixed in both sides just within the hymen, mark the limits of the denudation. The tenacula are crossed to show the size to which it is proposed to reduce the reconstructed outlet.

third tenaculum is now fixed in the vagina in the median line posteriorly, e crest of the vaulted prominence of the rectocele, or posterior column Fig. 174).

ith these three points fixed, the area of denudation must now be out- with a sharp scalpel. The bloody outline obviates the liability to error free-hand denudation. No one pattern will fit all cases; as an excessive ation requires a more extensive resection than one of moderate degree.

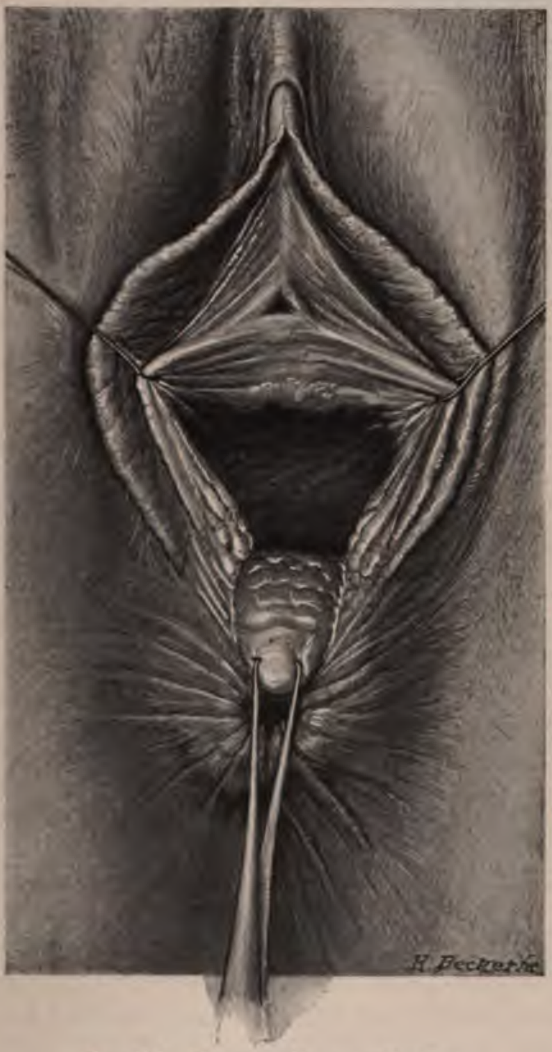


FIG. 174.—RELAXED VAGINAL OUTLET.

wing the shepherd's-crook tenacula fixed at the sides, below the urethra, and the tenaculum drawing the posterior columna downward, so as to expose the lateral vaginal walls where the lar denudations are made.

he surface to be denuded is irregular in outline and occupies several planes, ng it difficult to represent it adequately in a picture. In making the out-

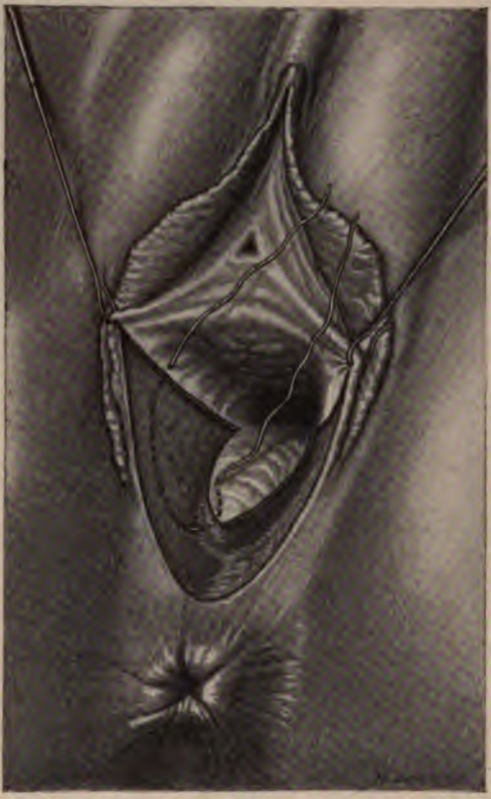


FIG. 175.—RELAXED VAGINAL OUTLET.

The silkworm-gut tension suture is placed in the triangle on the right side. The dotted lines represent the part of the suture which lies concealed under the surface. The short piece of the suture visible as a white line at the bottom of the denudation is the part which is exposed by bringing the needle out at the bottom of the wound and reëntering it close by.

line the central tenaculum and one of the lateral tenacula are drawn widely apart, downward, and outward, exposing one of the vaginal sulci. If there be a moderate degree of relaxation the apex of the triangle outlined in each sulcus is situated 3 cm. (1⅕ inches) within the outlet. By depressing the convex posterior vaginal wall a distinct line will be seen at the juncture of the anterior and lateral walls. An incision should be made down to the lateral tenaculum through the vagina, parallel to and just below the anterior wall. From the same point within, the second side of the triangle is made by an incision down to the tenaculum at the crest of the rectocele. A narrow, triangular, undenuded area remains between the two triangles thus formed in the sulci (see Fig. 175). The outline is now completed by a semicircular incision extending around the posterior wall, keeping within the hymen above, but embracing any scar tissue seen below. The center of this line falls 3 to 4 cm. (1 to 1½ inches) below the tenaculum fixed in the posterior column. The area thus outlined is rapidly denuded with Emmet's right-curved scissors, removing the whole thickness of the vaginal walls in long strips 3 to 4 mm. (1/16 to ⅙ inch) broad. At first the strip of tissue follows the line of the incision down to the apex of one of the triangles; then it continues back, and is carried to and fro across the front and up into the other triangle; frequently the whole outlined area can be removed in a single strip. The dissection is often facilitated by running the ends of the scissors beneath the lax tissue on the floor of the vagina. Arterial and venous hemorrhage from cut vessels is sometimes free, but the venous flow lasts only a short time and ceases spontaneously. An actively spouting artery should first be clamped for a time in the artery forceps, and if it persists in bleeding it may be tied after a few moments with catgut. By judicious application of the deep tension and the approximation sutures, much hemorrhage can be checked without the use of buried sutures at all.

The large wound area is now accurately approximated by means of from three to four silkworm gut sutures, and from eight to twelve half-deep and superficial catgut sutures. But one silkworm gut suture is placed within the vagina, in either sulcus. An assistant exposes one of the triangular areas by drawing the tenacula at its base downward and outward; a carrier is entered upon the mucosa on the lateral vaginal wall near the incision, a little below the middle of the triangle, and carried under the tissue toward the operator, appearing at the bottom of the sulcus, considerably below the point of entrance; it is reëntered close by and carried in the reverse direction, finally emerging on the mucosa of the opposite side of the triangle (and opposite the point of entrance). A stout silkworm gut suture sharply bent upon itself, 2 cm. (¾ inch) from the end, is hooked into the loop of the carrier and drawn through, then pulled up and tied in a square knot, care being taken to adjust accurately the edges of the wound before tying. The suture thus placed draws together a large area of tissue. To close the wound accurately above the suture its ends are grasped between the third and fourth fingers, and by traction the upper part of the triangle is exposed, as a narrow ellipse, with loosely approximated

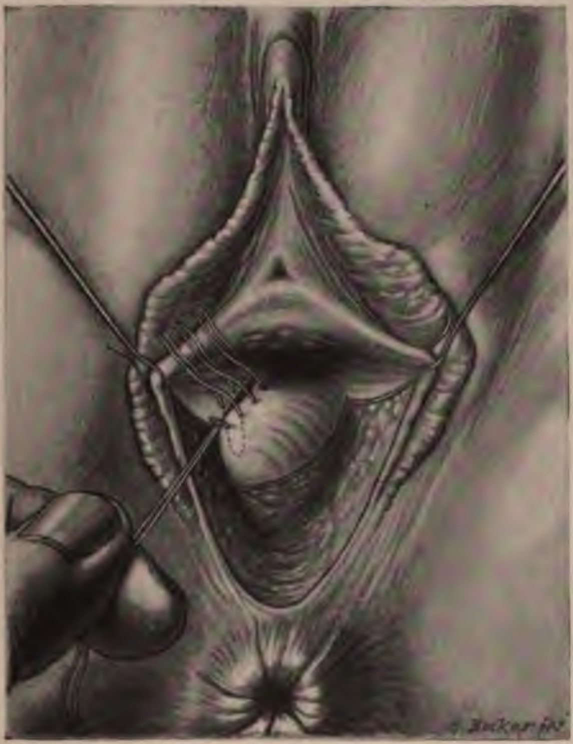


FIG. 176.—RELAXED VAGINAL OUTLET.

The silkworm gut suture is tied and pulled down, exposing the catgut sutures in place and ready to be tied, closing accurately the upper part of the denudation, already brought loosely together by the silkworm gut. These catgut sutures must pass deeply into the tissues so as not to leave a pocket in the wound below them.

sides. Perfect union is secured here by fine catgut sutures, carried deeply from side to side. The first is placed but a short distance above the one of silkworm gut, tied here, and used in its turn as a tractor, exposing the wound immediately beyond; then the next suture is passed and tied and so on, until the upper part of the triangle is closed and all bleeding has stopped. The opposite sulcus is closed in the same way with a single suture of silkworm gut and several of fine catgut. These sutures should check all hemorrhage, but if there is persistent oozing it must be controlled by additional sutures tied tightly at the bleeding point. In this way a large part of the resected area within the vagina has been approximated, and the vaginal canal markedly narrowed within the pelvis. When the triangular areas in the sulci are large, a half-deep catgut suture should be added below the one of silkworm gut.

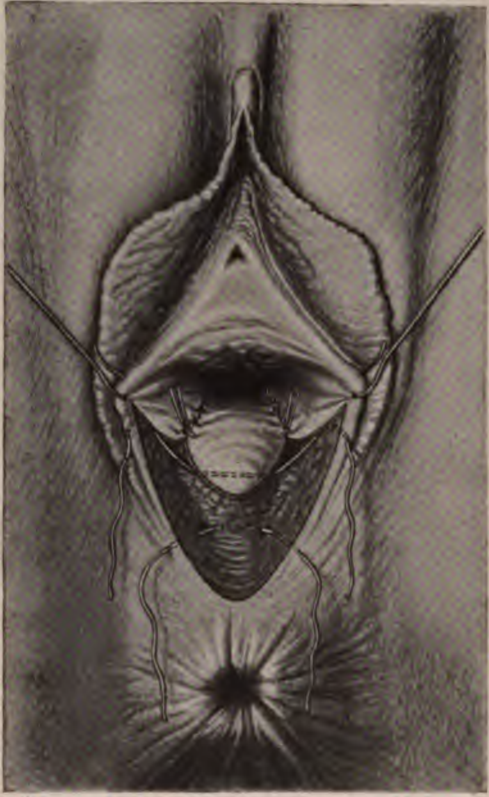


FIG. 177.—RELAXED VAGINAL OUTLET.

The inside sutures are now introduced and tied in both sulci. The gathering suture of silkworm gut is introduced above across the angles, but is not tied. An auxiliary suture introduced to close the wound below this is also left untied.

Most of the remaining area may be brought together by a single gathering suture of silkworm gut, embracing the upper angles on the sides and transfixing the rectocele (see Fig. 177).

An additional silkworm gut suture may sometimes be necessary on the skin surface extending through to the bottom of the wound. Half-deep and superficial sutures will complete the union.

When there is much relaxation, it adds to the efficiency of the operation to bare the levator ani muscle in each sulcus and include it in the deep inside silkworm gut sutures, as recommended by Dr. C. P. Noble.

The duration of the operation is from fifteen to thirty minutes. The outlining takes about one minute and a half, the denudation three or four minutes, and passing the sutures ten minutes longer; various minor matters may lengthen the time to half an hour.

The result of the operation is now evident in the change in the position, size, and direction of the vaginal outlet. It has been lifted and restored to its position well beneath the pubic arch. Its size has been reduced from 5 or 6 to 1½ or 2 cm. (¾ to 2¼ inches) in diameter. The examining finger no longer enters in the direction of the promontory of the sacrum, but goes backward toward the coccyx. This change in direction and position of the outlet removes it from the line of intra-abdominal pressure in which it has lain. Instead, therefore, of the constant tendency to eversion of the vaginal wall through a wide opening, the pressure is spent in forcing the anterior vaginal wall down upon the posterior one, and both upon the restored pelvic floor.

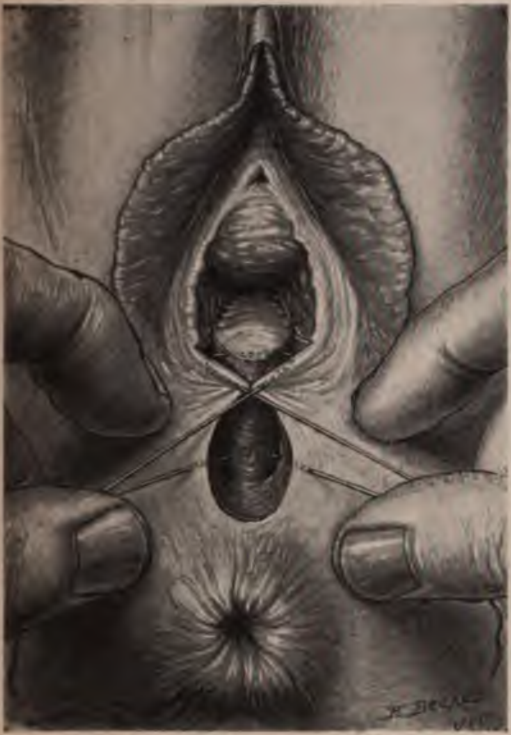


FIG. 178.—RELAXED VAGINAL OUTLET.

Showing how the gathering suture above draws together the tissues.

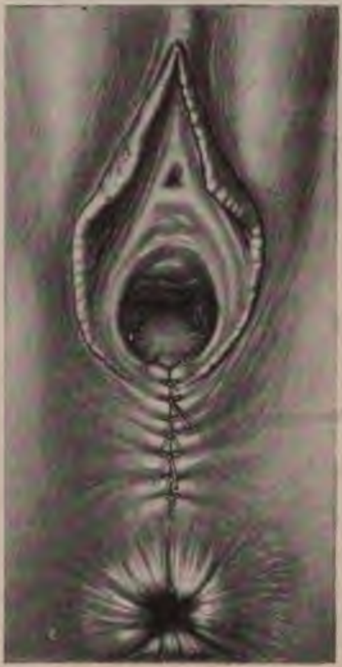


FIG. 179.—RELAXED VAGINAL OUTLET.

Operation completed. The sutures with longer ends, two inside and two outside, are of silkworm gut; the others are all of catgut.

The external sutures should be removed from the eighth to the tenth day. Those inside may remain several weeks.

The immediate result of this operation is a complete restoration, and even the hymen is often restored. Subsequent labors will not destroy the effects of the operation, unless unskillfully conducted or attended by complications.

In cases with very marked relaxation associated with rectocele, simple suture together of the anterior borders of the levator ani muscles in the median line oftentimes gives the best results. The disadvantages of this operation are that hemorrhage is free and often difficult to entirely control, moreover it is hard to avoid leaving dead space. My former associate, Dr. G. R. Holden, has recently devised a method (*Amer. Jour. Obstet.*, October, 1905,

p. 497) whereby these two dangers are avoided, and a firm solid perineal body is built up.

Dr. Holden's technique is well shown in the accompanying figures. The area of internal denudation is triangular, the apex of the triangle lying from 4 to 6 cm. from the outlet in the median line. If the limits of the denudation are outlined by a sharp knife the mucosa is easily removed in strips with the Emmet scissors. The levator ani muscles are now felt lying just behind the ascending ramus of the ischium. The levator ani on the left is caught by mouse tooth dissecting forceps, pulled out toward the median line, and then transfixed by a round needle bearing a ligature (see Fig. 180). This ligature is not tied. Its ends are held by a clamp, and it acts simply as a tractor on

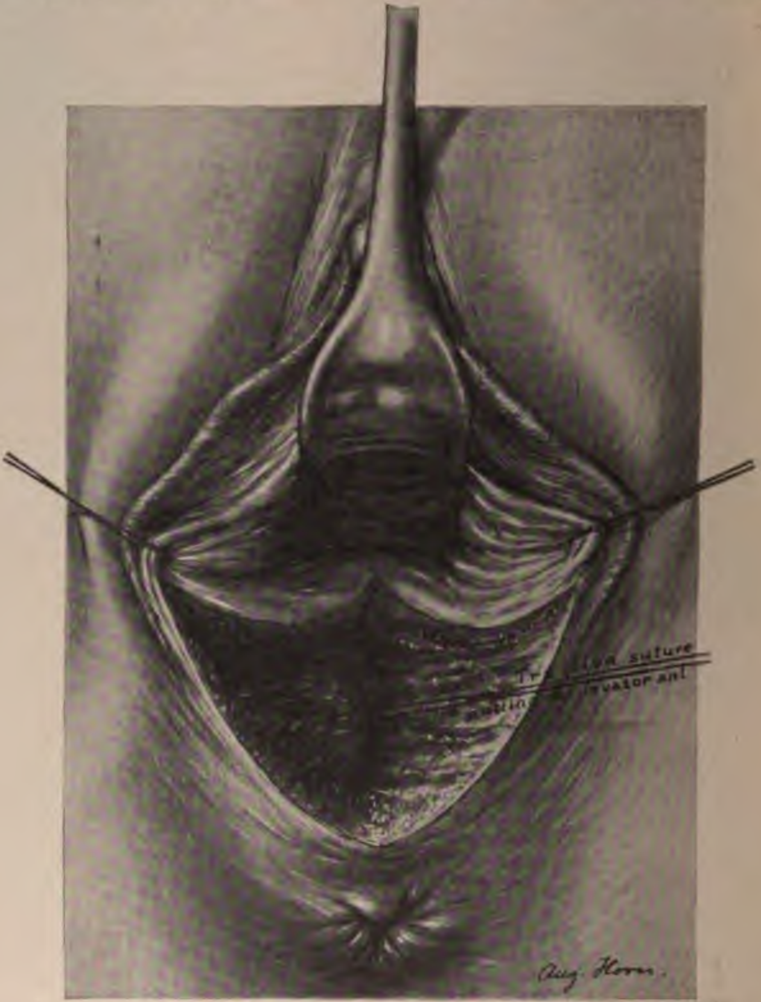


FIG. 180.—HOLDEN'S OPERATION FOR UNITING THE LEVATOR MUSCLES.

Denudation completed. The temporary silk suture has been passed through the levator ani on the left, and traction on the suture makes the muscle stand out.

the muscle. A similar ligature is passed through the levator muscle on the other side. The fascia over the muscle is not cut, and the bleeding is slight.

Two external sutures of silkworm gut are now introduced, as shown in **Fig. 181.** Each suture passes first through the skin and subcutaneous tissue, then through the levator ani on the same side. A good deep bite is taken, passing through the entire muscle. An assistant pulls on the traction suture passing through the muscle, making it stand out. The operator depresses the rectum with the forefinger of the left hand, while passing the lowest suture, and is thus able to pierce the muscle just above the rectum. Each stitch then

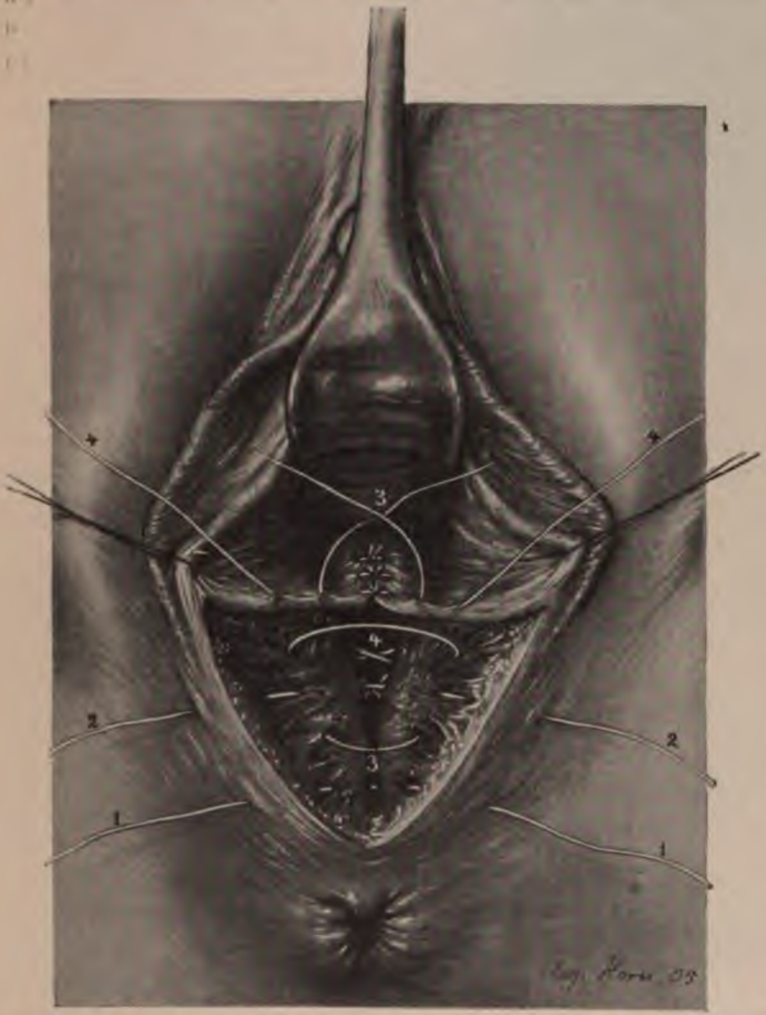


FIG. 181.—THREE INTERNAL STITCHES, APPROXIMATING THE MUCOSA, HAVE BEEN PLACED AND TIED.

The two formalin catgut figure-of-eight sutures (3 and 4) have been placed and are ready to tie. They pass through mucosa and muscle. The temporary traction sutures through the muscles are no longer necessary and have been removed. Avoid dead spaces.

passes directly through the muscle on the opposite side from behind forward, and, afterwards, through the subcutaneous tissue and skin on that side. When these sutures are drawn tight the effect is to draw the two levator ani muscles together and also to hold them firmly against the external tissues (see Fig. 182).

The silkworm gut sutures are not tied until after the internal stitches are placed and tied. The traction stitches through the muscles may now be removed. The internal stitches are of plain catgut and begin at the apex of the triangle. Three or four stitches are taken, uniting the cut edges of the mucosa and catching enough of the raw surface between to prevent any dead space and stop any hemorrhage which may be taking place. Usually but three such stitches are taken. It is now time to place the internal figure-of-eight stitch, which is best understood by reference to the diagram. This suture is of formalinized catgut or silkworm gut. It starts on the right-hand side, passes through mucosa and underlying tissue to the muscle, then, without touching the muscle of that side, it is carried across to the opposite side, and pierces that muscle from behind forward; it then goes to the muscle on the first side, piercing it from before backward; finally, passing to the opposite side, it is brought out through the mucosa and the underlying tissues in the same way and at a point corresponding to that of entrance (see Fig. 182). One of the sutures pierces the muscles between the two silkworm gut stitches. The other is placed above the uppermost silkworm gut. When these sutures are tied the two muscles are brought into close approximation; they are also bound firmly to the vaginal mucosa. By tying them the posterior half of the perineal body is formed. As shown in the

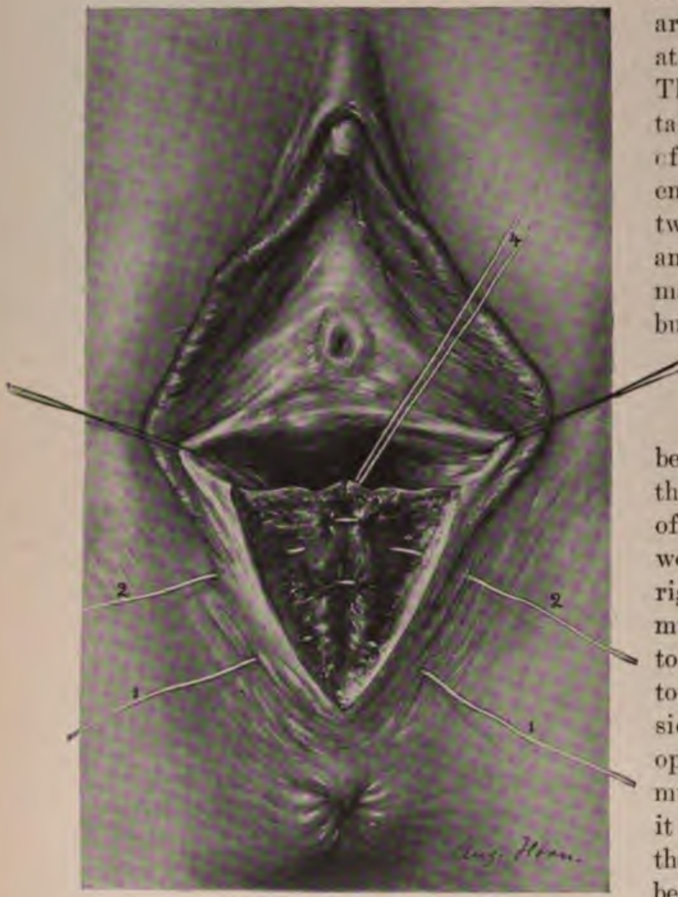


FIG. 182.—BOTH FIGURE-OF-EIGHT SUTURES HAVE BEEN TIED.

The muscles are closely united to one another. The cut edge of the mucosa is united internally. The mucosa is drawn down to the muscles behind and the only suture seen is the long ends of the last figure-of-eight suture (4) which have not yet been cut. 1 and 2 close the perineal wound.

picture, a wall of muscle is built up, covered on its posterior aspect by vaginal mucosa. Now, by tying the silkworm gut sutures the muscular wall is covered in front by skin and subcutaneous tissue. A stitch or two of plain catgut is sometimes needed to approximate a few raw edges left at the upper margin of the new perineal body (see Fig. 183).

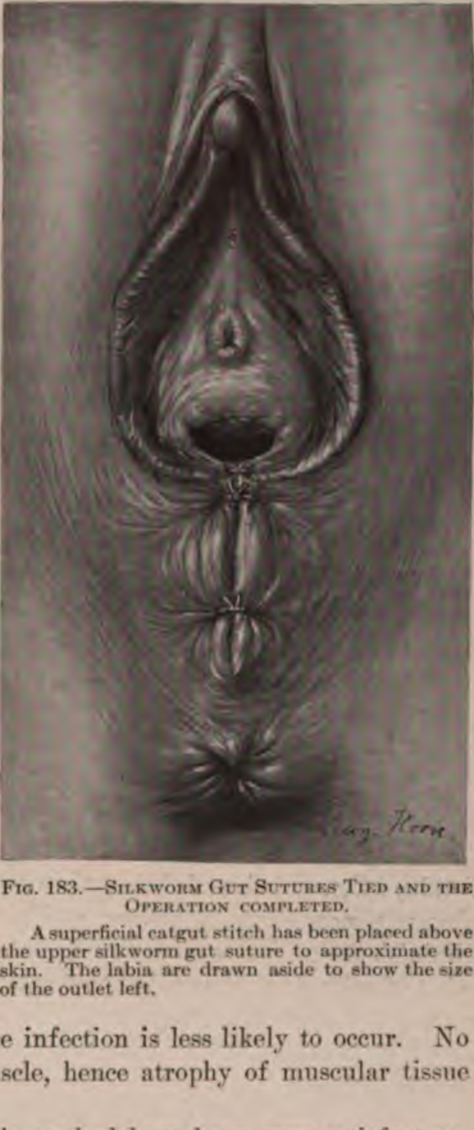


Fig. 183.—Silkworm Gut Sutures Tied and the Operation completed.

A superficial catgut stitch has been placed above the upper silkworm gut suture to approximate the skin. The labia are drawn aside to show the size of the outlet left.

The advantages of this operation are:

1. The vaginal outlet is narrowed. Its direction is made to lie at an angle with the direction of the upper part of the vagina, and the entire outlet is lifted up. This change in direction and position removes the outlet from the line of intra-abdominal pressure, as in the Emmet operation.

2. A thick solid perineal body, containing voluntary muscle, is formed, a true sphincter vaginæ.

3. The rectum is pushed back of this perineal body, thus obliterating the rectocele.

4. The operation is simple, but, as a rule, seven sutures are employed.

5. As the muscles are not pulled forward out of their sheaths there is no bleeding of importance during the operation. The manner in which the sutures are placed obliterates all dead space and checks any bleeding which may be present.

6. No buried sutures are used; hence infection is less likely to occur. No stitches entirely embrace an area of muscle, hence atrophy of muscular tissue is very unlikely to occur.

The operations done according to this method have been very satisfactory. Patients seen six months after it have still a strong muscular control of the vaginal introitus.

CHAPTER XVI.

DISEASES OF THE VAGINA.

1. **Introductory (p. 308): *a.* Anatomy. *b.* Intrinsic affections, few. *c.* Traumatic affections, largest group. *d.* Diseases from extension.**
2. **General surgical principles (p. 308).**
3. **Foreign bodies (p. 310).**
4. **Vaginitis (p. 312).**
5. **Vaginal cysts (p. 315).**
6. **Abscess of Gartner's canal (p. 330).**
7. **Neoplasms (p. 331): *a.* Benign. *b.* Malignant; sarcoma and carcinoma.**
8. **Traumatic affections (p. 335): Of the vault; of the orifice; of the canal. Strictures—falciform and annular. Atresia.**
9. **Recto-vaginal fistula (p. 341).**

The vagina is a simple musculo-membranous canal, lined by stratified epithelium. It is distinctly funnel-shaped, its lower extremity being contracted and lying beneath the pubic arch, while its expanded upper end, flattened anteroposteriorly, rests upon the pelvic floor and receives the cervix of the uterus.

The list of its surgical affections is a short one. The most frequent and important are the ruptures at either extremity occurring during parturition; those above which are produced by the extension of a tear beginning in the cervix and continuing out into the vaginal vault on one or both sides, and those below which are oftenest found in association with a lacerated outlet. Other vaginal affections, such as malformations, cysts, and neoplasms, are rare.

Uterine tumors, such as a polyp or an inverted uterus filling the lumen of the vagina, are not reckoned among vaginal diseases.

The vagina being in the form of a sac, all its surgical diseases, except fistulæ, affect the size of the canal in one way or another; foreign bodies, cysts, abscesses, neoplasms, cicatrices, and atresiæ, all encroach upon the lumen and diminish the caliber to a varying degree. The injury at the outlet alone has the effect of enlarging the canal at this point. Destructive diseases, such as sloughs, ulcers, and carcinoma, perforate the walls, establishing fistulous communication with the bladder in front, the rectum behind, or even with the small intestines above.

GENERAL SURGICAL PRINCIPLES.

The surgical principles involved in the treatment of vaginal diseases relate to:

1. The thorough cleansing of the field.
2. The proper exposure for operation.
3. The careful removal of existing disease, avoiding injury to important neighboring viscera.

4. The control of hemorrhage.
5. The closure of the wound by suture.

The vagina must be thoroughly cleansed before every operation. After bringing the buttocks to the edge of the table on a drainage pad, as in all plastic operations, the assistant retracts the posterior commissure with two fingers, or in a virgin with a narrow speculum, and introduces into the vagina a ball of cotton about 3 cm. (1.2 inch) in diameter, coated with soft soap, grasped in a pair of forceps; warm water is then poured in from a vessel above, and the upper vaginal tract thoroughly cleansed by vigorously scrubbing for several minutes in all directions, taking care to distend and cleanse between the folds. All parts of the vault will be better reached if two fingers are introduced, the middle finger pushing the vaginal tissue down or to one side, while the index finger pushes the cervix in the opposite direction. By repeated washings with fresh pledgets of cotton and soap, followed by douching with warm water, all *débris* and loose epithelium are gradually softened and removed. The lower vaginal tract is cleansed in like manner. Where discharges are escaping out of the cervix there is a constant liability to reinfection. It is best in such a case to dilate and curette the uterus, and then to pack the vault of the vagina with iodoform gauze during the performance of an operation.

Exposure of the Field.—In women who have borne children there is usually no difficulty in opening the vaginal outlet wide enough to expose and permit easy access to all parts of the canal by means of retractors in front and behind. The upper retractor fitting under the symphysis pubis should be narrow, with its blade spreading outside to keep the labia minora from dropping over the outlet and so obstructing the view; the posterior retractor must be broad enough and long enough to stretch the vagina and afford a good view of its walls, including the cervix. I found it necessary in one case, in order to reach a malignant disease of the vault of the vagina, to split the pelvic floor from the fourchette around the anus to the sacro-coccygeal joint, and dissect down beside the rectum, turning it to one side.

In the removal of diseased tissue it is important to bear in mind the topographical relations of the parts. In the first place, there are no organs except the ureters in the vicinity whose integrity is essential to life; thus, if uterus, bladder, or rectum are involved together with the vagina, portions of these structures may be sacrificed in removing the diseased tissue.

Even a considerable segment of the rectum may be removed and the upper and lower ends brought together. The exsection of portions of the bladder requires careful attention to avoid injuring the ureters, whose location is indicated by the ureteral folds in the anterior vaginal wall.

The hemorrhage encountered in vaginal operations is never alarming, and is readily controlled by forceps and ligatures. Bleeding from the vaginal walls may always be controlled by the sutures approximating the edges of the wound.

Silkworm gut is the best suture material where there is tension, but silk and catgut may both be used.

Cleanliness is maintained after the operation by keeping the vaginal outlet dry and well protected. As soon as there is any discharge from the vagina the pack should be removed, and if the discharge is sweet-smelling the further care should consist in applying iodoform and boric acid powder (1 to 7) and absorbent cotton over the outlet. If the discharge is ill-smelling at any time, the vaginal douches must be given once or twice daily. I find the pleasantest and most efficient douche to be two drops of menthol and a teaspoonful each of bicarbonate of soda and borax, dissolved in half a liter of hot water and used warm.

The various surgical affections of the vagina may be considered under the following heads:

1. Congenital affections. (See Chap. XI.)
2. Foreign bodies.
3. Cysts.
4. Neoplasms.
5. Traumatic affections and atresiæ.
6. Recto-vaginal fistulæ.

FOREIGN BODIES.

The one foreign body found in the vagina with any degree of frequency is a pessary, introduced for therapeutic purposes. The pessary becomes injurious when it is too large, or when, owing to its composition, it gives rise to foul secretions, or when left in too long. Our predecessors much more than our present-day practitioners committed the error of trying to effect by the size of the pessary what they could not attain by its skillful adjustment. I once removed a Hodge pessary large enough for a mare, which had been thrust into the vagina years before to relieve a simple flexion. In another case I found an old woman in a low typhoid condition which was inexplicable, until a fetid leucorrheal discharge was discovered; then on vaginal examination a large, thick ring pessary was felt choking the vagina. On removal, it was found to be made of cloth covered with an impermeable paint and stuffed with fiber. It had been introduced in Germany fifteen years previously, and had produced such extensive ulceration of the vagina with absorption from the raw surfaces as to bring on the typhoid condition in which the patient died, in spite of the removal of the cause and repeated careful cleansing of the wound surfaces.

In another instance a stem pessary, which had been introduced by the family physician, was thought to have been lost, as examination failed to reveal its presence in the vagina. Later, the patient began to suffer intensely, and came to the hospital in a septic condition; on examination, the pessary was found lying transversely across the vagina, one end having buried itself in the perineum, where it was felt as a hard body, while the cup had ulcerated its way into the bladder, producing a vesico-vaginal fistula. It was removed by breaking it to pieces with the bone forceps. The patient did not rally from the septic condition, and died in a few days.

Soft rubber ring pessaries commonly produce a free leucorrhea, often with intense itching of the external genitals, and for this reason I have abandoned them. The effect of a hard rubber pessary, which is too large, is to imbed itself in the posterior vaginal wall. On removing such a pessary a deep semicircular sulcus may be seen back of the cervix and extending out on the lateral walls. If granulations meet over the posterior bar, this part of the pessary is completely buried, and must be cut out to be removed.

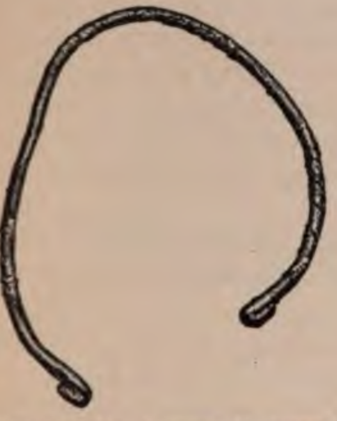


Fig. 184.—Child's Bangle Removed from the Uterus by Dr. Anna L. Church in Madras, India.

It was inserted within the uterus after confinement by a native midwife to prevent prolapse. Four or five months later the patient complained of pain, and Dr. Church found one end of the ornament in the external os, while the rest of it lay within the uterus. It was removed by manipulation.

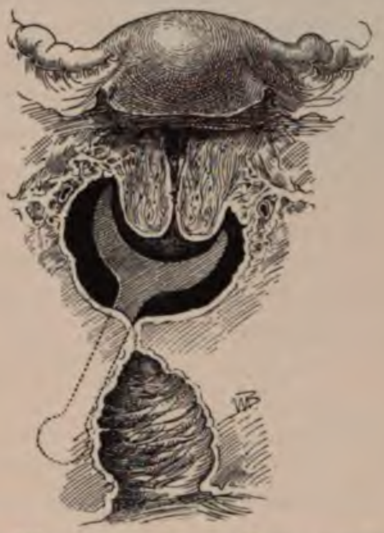


Fig. 185.—Atresia of the Vagina due to a Cup and Stem Pessary.

Above the atretic area the vagina is filled with pus. The stem of the pessary is outlined where it lay buried in the tissues to the right.

In more extreme cases the ulceration extends through into the rectum behind, and the anterior bar pushes through the vesico-vaginal wall into the bladder in front, forming recto-vaginal and vesico-vaginal fistulæ. Instances of ulceration even into the peritoneum are also recorded.

Fig. 184 shows a child's bangle, removed from the uterus by Dr. Anna L. Church, of Madras, India. This curious article had been inserted within the uterus after delivery by a native midwife, to prevent prolapse. The patient came into Dr. Church's hands four or five months later, complaining of pain. One end of the bangle was found at the external os uteri, and by means of this, it was easily extracted.

The treatment of such cases is removal of the foreign body and cleanliness of the wound by means of repeated irrigations until it is healed, when the fistula is closed. Careful note must be taken of the fact that where the foreign body has been in place for years the vaginal orifice often becomes so contracted as to prevent its withdrawal by simple traction through the outlet without laceration. The effort may be first made to remove it by traction in the direction of least resistance, after cleansing the vagina thoroughly and injecting into it a large quantity of vaseline. If the pessary can not be extracted in this way without injury, either on account of its size or because of the incrustations covering it, the operator must remove it in pieces. To do this he will have better command of the field and be less liable to injure the vagina, with the patient in the knee-breast position and the posterior vaginal wall well retracted by a broad Sims speculum. The pessary is then easily seen, and caught with a pair of stout forceps, which fix it firmly, while with bone forceps it is cut into pieces small enough to be readily removed. If the forceps can not break it, a metacarpal saw may be used.

Ulcerated areas should be freely penciled with a 5 per cent nitrate of silver solution every four or five days, and warm boric acid douches used twice daily until the wound has healed.

VAGINITIS.

Vaginitis, or, more correctly, colpitis, is an inflammatory affection of the vaginal mucosa usually due to a bacterial infection.

Vaginitis may also be the result of the application of an irritant to the vagina, but the disease does not persist unless the inflammation is kept alive by the invasion of one or another of the pathogenic organisms. A vaginitis is also often produced by the irritant effect of a foreign body in the vagina, such as a pessary, particularly if the pessary has been transferred from another person without being sterilized.

Although a variety of micro-organisms form the real basis of the different forms of inflammation of the vagina, but few of these have as yet been identified, and it is often impossible to name the true cause in a given case. The best known forms of bacteria liable to produce a vaginitis are, the gonococcus, the tubercle bacillus, an organism resembling the oïdium albicans, and a gas bacillus.

Gonorrheal vaginitis is rare, and so experienced an observer as Bumm (Veit's *Handb.*, Bd. i, p. 474) declares that he has seen only five cases all told.

Too great care, therefore, can not be taken in establishing such a diagnosis. Bumm considers that the cases commonly considered as gonorrheal vaginitis are merely the result of the secondary irritation proceeding from the stagnation of purulent discharges from an infected cervix. He quotes further experiments made in v. Rinecker's clinic in Würzburg, in 1880, where the vagina was allowed to remain for twelve hours in contact with a gonorrheal secretion without any manifest result.

Veit, on the other hand, is inclined to lay much stress on the gonococcus as an etiological factor.

The exemption of adult women is apparently due to the thick impervious vaginal epithelium; in young children, on the other hand, and even in young women, where the vaginal epithelium is tender and succulent, an infection of this sort is far more liable to occur.

Pregnancy, by the increased blood supply to the genital organs, with the attendant softening of the tissues, increased moisture, and loss of the superficial layers of the vaginal epithelium, predisposes to inflammatory processes, and a slight trauma may suffice to bring about an acute colpitis. At this time we observe the following two forms, which are almost unknown at any other period.

Aphthous vaginitis, which is due to the presence of a vegetable parasite, resembling closely the oïdium albicans, appearing in white raised patches on the reddened vaginal wall, and in the shape of small white flakes in the vaginal discharges.

The other form of vaginitis is known as **colpo-hyperplasia cystica**, and is characterized by the presence of gas cysts in the vaginal mucosa, the formation of gas being due to a bacillus which has been isolated by several observers. The gas is found in cavities in the interstices of the connective tissues.

A vaginitis may also be due to contact with the irritating discharges of a carcinomatous cervix.

Senile vaginitis is peculiar to old age, when the vagina is atrophic and has a poor blood supply; if at this time an inflammation is set up by an irritating uterine or cervical discharge, or if a trauma occurs from coitus or other cause, the result is an ulcerated area which is slow to heal, or adhesions may form chiefly at the vaginal vault, giving rise to the **adhesive vaginitis** of old age.

Finally, there is found at times, accompanying febrile or exanthematous diseases, a severe form of vaginitis, which may present the picture of diphtheritic vaginitis, so called from the false membrane formed, either in localized areas or almost entirely covering the vagina. The inflammation may even be severe enough to terminate in gangrene and sloughing of the vagina.

These cases are usually masked by the acute general symptoms of the disease, and in the worst forms are almost always fatal. The results of the less severe forms are seen afterwards in **atresia** or **stenosis** of the vagina.

A **chronic** form of vaginitis is also seen, characterized by thickening and prominence of the papillæ of the mucous membrane, by a thin purulent discharge, and, sometimes, by ulcerated areas in various parts of the vaginal wall.

The symptoms of a vaginitis vary greatly, from the acute form, where the patient is unable to move on account of the severe pain, with its attendant vesical and rectal tenesmus, to those cases where the only complaint is of irritation of the external genitals, with some vaginal discharge.

On examination in an acute case, the labia and surrounding skin show signs of inflammation, being reddened, thickened, and smeared with a whitish purulent discharge. On separating the labia the discharge will be seen issuing from the vaginal orifice, which may be pouting and of a deep-red color.

On introducing the finger the vagina will be found hot, swollen, and sensitive, the tissues feel softer than normal, and on withdrawing the finger it may show a little streak of blood. Under the speculum the vagina is of a deep-red color, the mucosa looks thicker than normal, and in places a velvety appearance, from the prominent papillæ, is noted. Small blood-red areas may also be seen which bleed on touch; these are points where the mucosa is thinned out and the blood vessels show more distinctly. This latter appearance was the origin of the name of "colpitis granulosa" for one variety of vaginitis.

The symptoms in the **senile vaginitis** are usually but slightly marked, and the condition is often discovered accidentally. There is usually a little purulent discharge, the vagina is smooth, injected uniformly or spotted with red, diminished in caliber and length, and coitus is interfered with.

In vaginitis accompanying pregnancy the principal complaint is the almost unbearable itching, which at times prevents the patient from sleeping.

The diagnosis of vaginitis can only be made by a thorough examination of the parts. The presence of a profuse curdy secretion covering the walls should not suffice, but this must be wiped off and the color and amount of swelling or thickening noted. The aphthous vaginitis may be distinguished by the small white flecks on the surface, which can not easily be wiped off, and by a microscopical examination of the discharge. The **colpo-hyperplasia cystica** is recognized by the presence of the cysts, which, on opening, are found filled with gas.

The diagnosis of gonorrheal vaginitis must always be carefully made, and if there is any doubt a gonorrheal source should not be suggested to the patient. The acute history, with the onset following six or eight hours after coitus, the profuse yellowish discharge with a slight pungent odor, the involvement of the urethra, cervix, and perhaps one of the vulvo-vaginal glands, will all help in the diagnosis, which must also be strengthened by a microscopical examination of slides, stained by the Gram and other methods.

The treatment of vaginitis depends to a large extent on the cause of the inflammation. The proper plan is to discover the cause, when possible, and remove it, after which the disease may be treated.

For example, a foreign body must be immediately removed, and in many cases this will be the only treatment necessary. The irritating discharges from a carcinomatous cervix or from a sloughing uterine myoma must first be checked by the removal of the growth and by vaginal douches.

The local treatment may be carried out by using medicinal substances in a watery solution, introduced through a syringe into the vagina, or by medicinal substances applied directly in viscous solutions or as dry powders.

Irrigation of the vagina is best practiced with a fountain syringe with a glass nozzle, which can be easily and thoroughly cleansed by boiling. The reservoir of the syringe should be raised only a foot or eighteen inches above the patient, and the injection should always be taken in the reclining position, the fluid entering the vagina slowly and the nozzle not being introduced over two inches. The patient should also lie quietly for a time after the irrigation is ended to allow the last of the fluid to remain in contact with the vaginal mucosa for a little while.

Various substances are used in this way, either for their antiseptic or astringent action, and combinations may be made in which both actions may be taken advantage of. The watery solutions most frequently used are bichloride of mercury, in strengths of from 1–40,000 to 1–10,000; carbolic acid, 20 or 30–1,000; potassium permanganate, 5–1,000; boric acid, 30 or 40–1,000; also, as astringents, tannin from 10 to 30–1,000; acetate of lead, 1 to 5–1,000; alum, 10 to 25–1,000.

When the discharge is acid, it will often prove of distinct advantage to use alkaline douches, such as lime water, soda water, etc.

The use of cotton tampons soaked in viscous solutions of various agents is also a good method of treating vaginitis, with, however, the drawback that the patient must see her physician every time it is necessary to renew the tampon, for it is usually impossible for her to introduce it herself. The tampons may be introduced either in the knee-breast or the left lateral position, or the dorsal position may be used with a bivalve speculum. The tampon should be soaked in the fluid or else the fibers can be separated enough to form a cavity in the center, in which the fluid may be poured. Each one must also have a cord attached firmly to it to facilitate the removal.

The substance generally used for the vehicle is glycerin, as this has itself a certain amount of action on the vagina. In this may be dissolved alum, 5–100, boric acid, 10 to 20–100, or ichthyol of 5 or 10 per cent strength.

Dry powders may be applied to the vaginal surface through a powder blower, or by means of a brush, or they may be inclosed in a wad of widemeshed gauze and introduced.

Nitrate of silver, in 5 or 10 per cent solutions, may be applied locally to ulcerated areas by an applicator wound with cotton.

The prognosis of most cases of acute vaginitis is good, if the cause can be removed. Gonorrheal vaginitis usually heals quickly, though there is always a chance of reinfection from the cervix or urethra, unless these also receive careful and prolonged treatment. The chronic and senile forms are hard to heal on account of the marked changes which the tissues have undergone, rendering rejuvenation impossible; the prognosis as to complete cure in these cases must therefore be guarded.

VAGINAL CYSTS.

Vaginal cysts have long been recognized and accorded a thorough consideration. Among the most important contributions to the subject are articles by Breisky, v. Winckel, Freund, Veit, Gebhard, and Bandler. Dr. J. E. Stokes has given a careful *résumé* of the literature, with a report of eleven cases (*Johns Hopkins Hospital Reports*, 1898–99, vol. vii, p. 109). Since the appearance of this article many new specimens have accumulated at the Johns

Hopkins Hospital, so that the total number examined there, including those reported by Stokes, amounted to 53, on January 1, 1904.

In order to facilitate a satisfactory consideration of the subject it may be well to consider it under the following heads: (1) Gross and histological anatomy of the normal vagina; (2) embryonic structures that may persist in the vagina; (3) changes in the vagina incident to vaginitis; (4) changes due to injuries resulting from childbirth; (5) alterations in the vagina caused by perineal operations; (6) relation of the urethra to the vagina; (7) cysts.

Anatomy of the Normal Vagina.—The lining of the cavity is composed of several layers of squamous epithelium; the more superficial of which, situated near the outlet, tend to become horny. The deepest layer, which rests on the underlying stroma, consists of cells, cuboidal or low cylindrical in type. The stroma is made up of fibrous tissue poor in cell elements, but, as a rule, well supplied with blood vessels. Small tufts of the stroma project up into the epithelium, producing the so-called papillæ. The vaginal mucosa resembles very closely the normal skin. Pigment in the deeper layers is, however, usually wanting.

Vaginal Glands.—The existence of vaginal glands has been much questioned, but F. von Preuschen in 1877, after a careful examination of thirty-six bodies, found definite vaginal glands in four, and C. Ruge discovered a gland in one of the sections of a vaginal cyst. The necks of these glands are lined by squamous epithelium, while the deeper portions, which spread out into definite bays, are lined by cylindrical epithelium on which cilia may be detected. Opening into the dilated glands are little crypts. Similar glands had been previously noticed in 1870 by Hennig. In one of our specimens which consisted of a small cyst 6 mm. in diameter and lined by one layer of cuboidal epithelium, I found a small, oval gland space lined with one layer of high cylindrical epithelium (see Fig. 186 *b*). It closely resembled a cervical gland and was surrounded by a definite inflammatory zone. It was impossible to tell whether the cyst was situated in the anterior or posterior vaginal

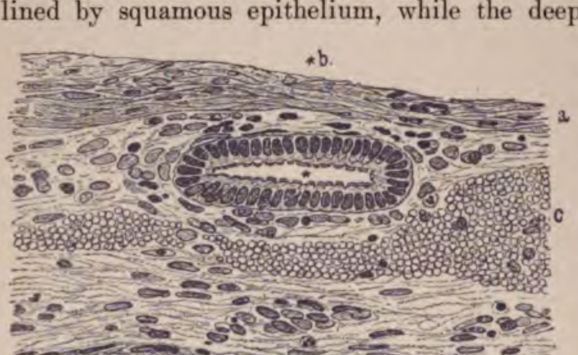


FIG. 186.—SECTION OF THE WALL OF A CYST FROM THE ANTERIOR WALL OF THE VAGINA, JUST TO THE RIGHT AND POSTERIOR TO THE URETHRAL ORIFICE.

The cyst walls were smooth, thin, and transparent; the cavity was empty, except for a few clumps of round cells here and there. *a*, Stratified epithelium; *b*, a vaginal gland lined with ciliated cylindrical epithelium situated in the connective tissue in the wall of the cyst; *c*, blood lying free in the stroma; *d*, large spindle-shaped connective-tissue cells; *e*, cylindrical ciliated epithelium lining the cyst cavity. Path. No. 1502. Magnified 360 times. (This figure is similar to that described in the text.)

wall. From the foregoing facts, there seems to be no doubt that vaginal glands exist in a moderate percentage of cases (see Fig. 186).

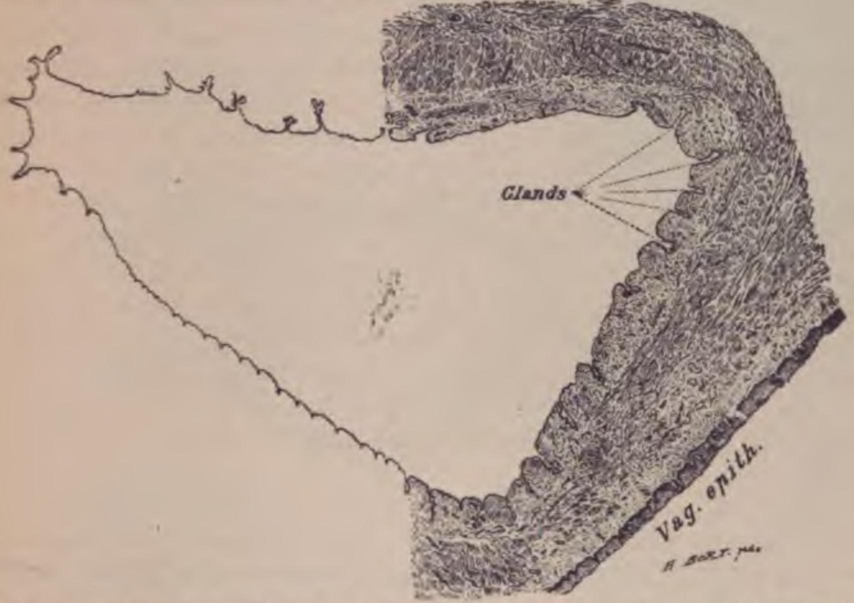


Fig. 187.—Cyst 8 by 5 Cm. in Size protruding from the Vagina and covered on its External Surface by Smooth Vaginal Mucosa; Egg-shaped and Densely Adherent to the Structures above the Vaginal Vault.

The walls, 3 mm. in thickness, are of a dark-grayish opaque color, and the cavity contains a semifluid, greenish substance. The cyst is lined with a single layer of high cylindrical epithelium, a true prototype of that found in the cervix. In places there are islets lined with epithelium like that lining the surface of the cyst; these islets sometimes dip down into the wall of the cyst a centimeter or more, and closely resemble true glands in their structure. Just beneath the lining epithelium of the cyst cavity there is a layer of connective tissue, and next to this comes a broad layer of non-striped muscle fibers cut longitudinally, transversely, and obliquely. A layer of normal stratified squamous epithelium lies over one portion of the outer surface. Case of Dr. C. P. Noble. Path. No. 1775. Magnified 4 times.

Embryonic Epithelial Structures Which May Persist in the Vagina.—These structures are:

(*a*) Gartner's duct.
(*b*) Remains of Müller's duct.
(*c*) Misplaced ureter.

(*a*) Persistence of Gartner's Duct.—In the embryo, remains of the Wolffian body are recognized as the parovarian tubules situated between the tube and ovary. The duct is continued downward, through the broad ligament, along the side, or in the substance of the uterus, as Gartner's duct. It lies in the substance of the cervix, near its outer side, and then extends down the lateral or anterior wall of the vagina nearly to the outlet (see Fig. 188).

In Fig. 189 we have a cross section of the uterus in a human embryo at the end of the third month. On either side of the uterine cavity a cross section of Gartner's duct is clearly seen.

Although it is sometimes possible in a human being to trace the duct for nearly its entire length, as a rule only the upper part is visible, and this usually disappears in time. The structure is best studied in the cow, as in this animal the duct is easily traced. Bland-Sutton gives a good illustration of Gartner's duct extending down the side of the cervix and in the lateral wall of the vagina, forming two distinct cystic dilatations.

Remnants of Gartner's duct are sometimes recognized as one or more disconnected segments, following the usual course of the duct along the lateral wall or roof of the vagina to the cervix. In some instances it has been possible to trace the duct from the vagina up to the parovarium; in other words it was patent for its entire length.

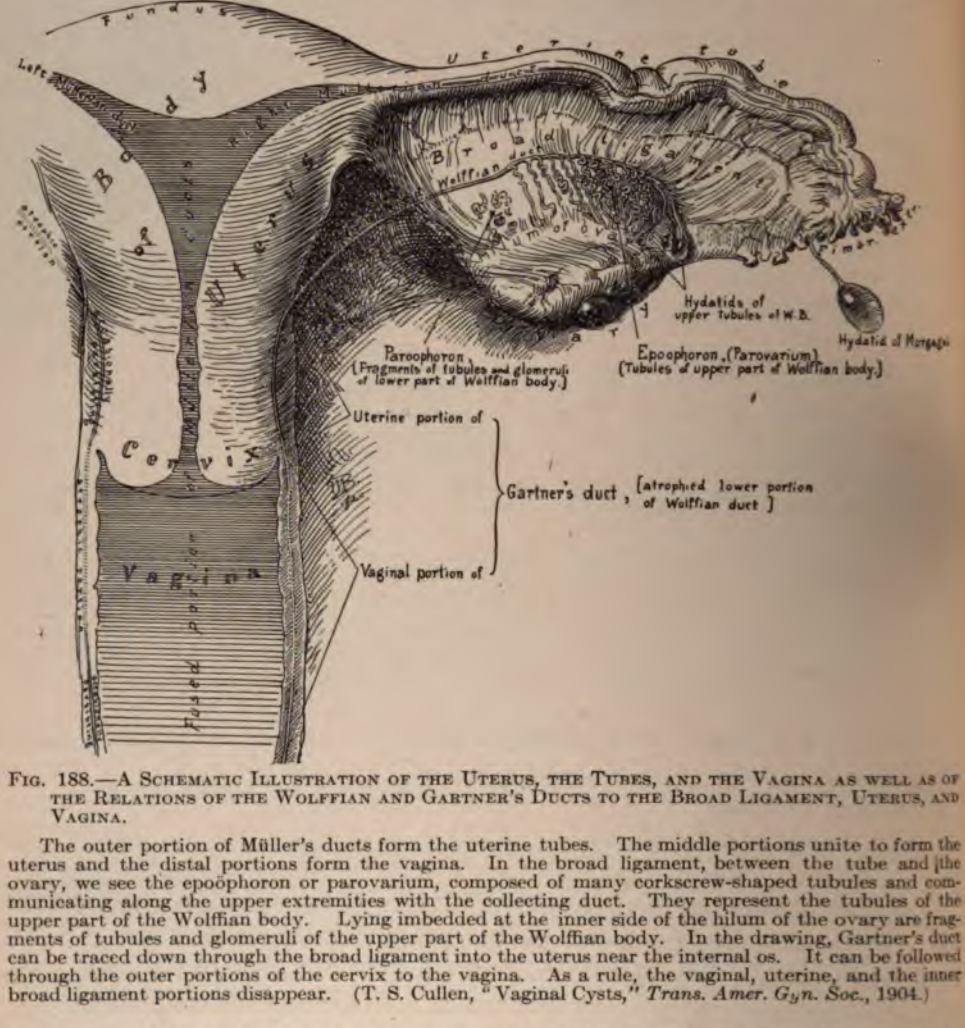

Fundus
Left
Body
Uterine tube
Broad ligament
Wolffian duct
Uterus
Cervix
Vagina
Paroophoron, (Fragments of tubules and glomeruli of lower part of Wolffian body.)
Epoophoron, (Parovarium) (Tubules of upper part of Wolffian body.)
Hydatids of upper tubules of W. B.
Hydatid of Morgagni
Uterine portion of
Gartner's duct, [atrophied lower portion of Wolffian duct]
Vaginal portion of

FIG. 188.—A SCHEMATIC ILLUSTRATION OF THE UTERUS, THE TUBES, AND THE VAGINA AS WELL AS OF THE RELATIONS OF THE WOLFFIAN AND GARTNER'S DUCTS TO THE BROAD LIGAMENT, UTERUS, AND VAGINA.

The outer portion of Müller's ducts form the uterine tubes. The middle portions unite to form the uterus and the distal portions form the vagina. In the broad ligament, between the tube and the ovary, we see the epoöphoron or parovarium, composed of many corkscrew-shaped tubules and communicating along the upper extremities with the collecting duct. They represent the tubules of the upper part of the Wolffian body. Lying imbedded at the inner side of the hilum of the ovary are fragments of tubules and glomeruli of the upper part of the Wolffian body. In the drawing, Gartner's duct can be traced down through the broad ligament into the uterus near the internal os. It can be followed through the outer portions of the cervix to the vagina. As a rule, the vaginal, uterine, and the inner broad ligament portions disappear. (T. S. Cullen, "Vaginal Cysts," *Trans. Amer. Gyn. Soc.*, 1904.)

A cross section of the duct will show: an outer covering of fibrous tissue, a middle zone of non-striped muscle, arranged longitudinally, transversely, or running in both directions, and an inner lining of one layer of cuboidal or cylindrical epithelium.

(*b*) **Remains of Müller's Ducts in the Vagina.**—In some instances Müller's ducts fail to fuse in the mid-line. We may then have two uteri and two vaginæ. In other cases the two ducts are separate in their upper portions and unite partially at the cervix. Thus we may have a bicornate uterus with two cervices and two vaginæ, or a bicornate uterus with one cervix and one vagina. Other minor variations occur resulting from failure of Müller's duct to unite, but we are here chiefly interested in the variety where one uterus is fairly developed, while a second is represented by a rudimentary cord or a very imperfectly formed organ. The corresponding vagina becomes fused with the lateral wall of the well-developed organ. Secretions may then accumulate in the rudimentary vagina, until it resembles a cystic tumor springing from the lateral wall of the vagina (see Fig. 190).

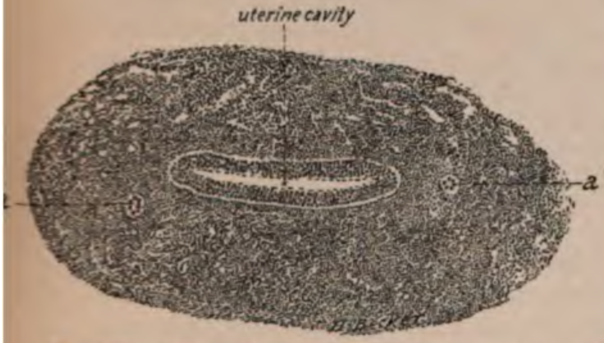


FIG. 189.—A CROSS SECTION OF THE UTERUS NEAR THE CERVIX SHOWING GARTNER'S DUCT ON EACH SIDE OF THE UTERINE CAVITY (FETUS AT THE END OF THIRD MONTH).

The uterine cavity is represented by a long slit lined by several layers of epithelium. Gartner's ducts are situated well toward the outer side of the uterus, are circular and lined by one layer of cuboidal epithelium. The uterine muscle is not yet well differentiated. (After Cullen, *ut supra.*)

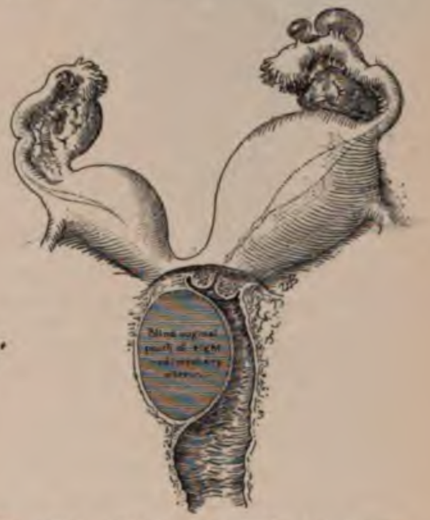


FIG. 190.—RUDIMENTARY VAGINA IN THE WALL OF A WELL-FORMED VAGINA.

A schematic illustration of a blind vaginal pouch due to the imperfect union of Müller's ducts. The left uterus is well developed and its corresponding vagina perfectly formed. The right uterus is rudimentary and its cervical portion is represented by a solid cord. The vagina is seen as a blind cystic pouch. Such cavities may collapse, but if distended contain quantities of exfoliated squamous epithelium. (Cullen, *ut supra.*)

Sometimes the accompanying uterus is fairly well developed and may communicate with the sac. In these cases the retained menstrual flow distends the blind vaginal pouch, and when the sac is opened, it is found filled with chocolate colored fluid (see Fig. 191). Sometimes the tension becomes so great that eventually a small opening forms and the fluid escapes through the vagina. Such sacs may also become infected before they open. Attention was first called to these rudimentary vaginæ situated in the wall of a well-developed vagina by W. A. Freund in 1877 (*Gynäkol. Klinik*, Strassburg, Bd. I, p. 321), who reported several cases. Kleinwächter reported similar instances shortly after Freund's article appeared (*Ztschr. f. Geb. u. Gyn.*, 1889, Bd. 16, p. 36).

(*c*) Abnormal Relation of the Ureter to the Vagina.—When the ureter is in its normal situation, its relation to the vagina is not an intimate one, but occasionally a case is met with in which a small cystic prominence is detected in one lateral wall, from which, when opened, an escape of urine takes place. In other, rare instances, a fistulous opening into the lateral vaginal wall has been found through which there occurs a constant discharge of urine. Where any history of injury to the vagina is excluded which could possibly have caused a fistulous opening between the normal ureter and the vagina, we are probably dealing with an embryonic abnormality. The latter alternative is more probable when there is a double ureter on one side. Many observers have pointed out that where two ureters and two kidneys exist on one side, the ureter from the lower kidney is usually inserted at the normal site, while the one connected with the upper kidney is carried down farther with the Wolffian duct, and is inserted more medianward and nearer the internal urethral orifice. It would only be necessary for this second ureter to be carried down a little farther to have it open into the vagina or form a blind pouch within it.

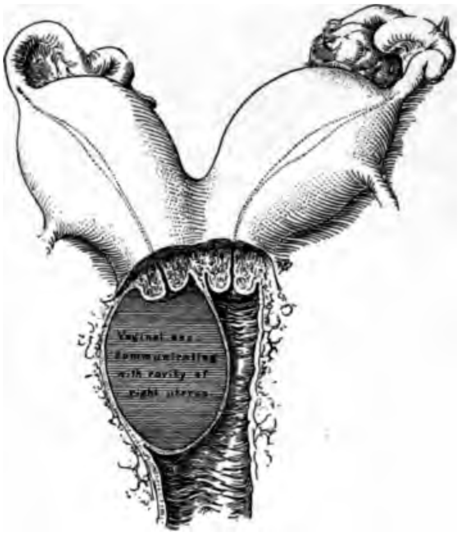


FIG. 191.—A BLIND RIGHT VAGINA COMMUNICATING WITH A WELL-DEVELOPED RIGHT UTERUS. A VAGINAL CYST HAS BEEN FORMED IN THE RIGHT FORNIX BY THE GRADUAL ACCUMULATION OF THE MENSTRUAL SECRETIONS.

Changes in the Vagina Incident to Vaginitis.—Adhesive vaginitis occasionally occurs, especially in young individuals. Here, as a result of an ulcerative process, or a severe grade of inflammation associated with the loss of the vaginal epithelium, the vaginal folds become adherent to one another, producing blind pockets. Such a vaginitis may be due to a general systemic infection, to gangrene following the presence of a foreign body in the vagina, or to the highly irritative urine accompanying inflammation of the bladder. These vaginal occlusions may have a definite bearing on the future development of vaginal cysts.

Changes in the Vagina Due to Injuries at Childbirth.—In many cases when the tears in labor are deep the injury has occurred in such a manner that little tags of mucosa lie in partially detached islets, and during the subsequent healing of the perineum these may be turned in and included beneath the edges of the wound. Under these circumstances we have squamous epithelium buried in the tissues from 1 to 5 mm. beneath the surface.

Alterations of the Continuity of the Vaginal Mucosa Due to Perineal Operations.—Where it is necessary to repair the outlet some time after labor, by removing a large area of vaginal mucosa, if this is cut away piecemeal, instead of in long strips, small fragments of the mucosa may be left behind (see Fig. 192). When the edges of the wound are approximated these islands of mucosa lie more or less deeply imbedded in the underlying stroma and entirely cut off from the parent mucosa, thus giving rise to cystic formations under the scar.

Relation of the Urethra to the Vagina.—It is very important to have a clear understanding of the relation of the vagina to the urethra, as they are intimately associated over a considerable distance. Furthermore, as will be seen later, certain cyst-like dilatations arising from the floor of the urethra should not be confused with vaginal cysts, although at first sight they may bear a striking similarity. Disse, in v. Bardeleben's "Anatomy," has given a clear description of the urethra, which I quote: "The posterior wall of the urethra is firmly attached to the anterior vaginal wall throughout its entire length. The canals run parallel to each other. The epithelium of the urethra is about 1 mm. thick. The superficial layers of cells are all composed of squamous epithelium. The cells of the deeper layers are more club-shaped. The mucosa is longitudinally folded, and as a result club-shaped and tubular depressions are produced. Some of these are simple lacunæ, others are grandular in nature and secrete a colloid material which may in time form concretions. The lacunæ are found in the entire length of the urethra. The smaller ones are broad-based and open by a narrow channel into the urethra. The larger ones are tubular, push into the propria, often branch and tend to run parallel with the surface. These are the glands that sometimes produce the hardened secretion. They are termed Littré's glands." On either side of the urethra are Skene's ducts, which must also be remembered in any consideration of vaginal cysts.

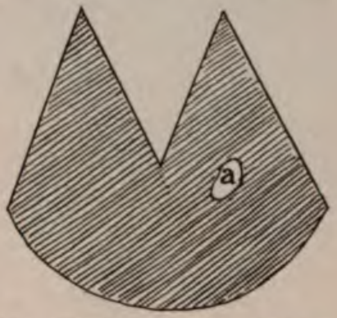


FIG. 192.—THE AREA OF DENUDATION IN AN EMMET OPERATION. AN UNDENUDED ISLET HAS BEEN LEFT AT *a*. THIS WILL IN TIME PROBABLY GIVE RISE TO A CYST.

Vaginal Cysts.—It is rather difficult to classify all vaginal cysts according to their origin, and the accompanying figures must be accepted as representing only an approximate ratio of the different varieties to each other. I have examined, in all, fifty-three cases of vaginal cysts, in a few of which two cysts were present in the same individual.

Variety of Cysts.—In twenty-six cases the cyst had clearly originated in a perineal tear or from a perineal operation.

Four seemed to originate from the vaginal glands.

Eleven were apparently derivatives of Gartner's duct.

Three were situated near the external orifice of the urethra.

In nine it was impossible to determine the mode of origin.

Inclusion Cysts (cysts due to small portions of the vaginal mucosa being included in the stroma).—Such cysts are relatively small, and are naturally found in the posterior or lower lateral wall of the vagina. They are often situated in the scar tissue of an old tear (see Fig. 193), or they may form a globular mass projecting from the posterior vaginal wall and covered by normal vaginal mucosa (see Fig. 194). In our cases the cysts varied from 3 mm. to 2.5 cm. in diameter. The smaller were yellowish in color, the larger more whitish in appearance. The cyst walls vary from 2 to 4 mm. in thickness; the inner surface is smooth. The cyst contents vary slightly. The smaller ones are often completely filled with a friable material which gives a yellowish tinge to the cyst. This substance at first sight slightly resembles pus, but in reality represents masses of exfoliated squamous epithelium.

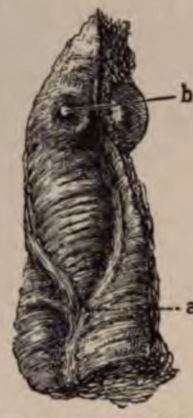


FIG. 193.—A VAGINAL CYST (*b*) DEVELOPING AFTER A PERINEAL OPERATION UNDER THE SCAR, DUE TO IMPERFECT DENUDATION AND THE INCLUSION OF AN ISLET OF MUCOSA WITHIN THE WOUND. *a* MARKS THE JUNCTION OF THE SULCI WITH THE PERINEAL WOUND.

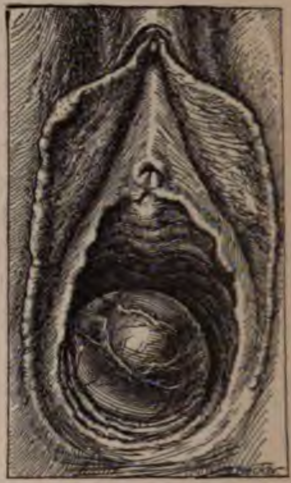


FIG. 194.—A VAGINAL CYST OCCURRING THREE YEARS AFTER REPAIR OF A PERINEAL TEAR.

Gyn. Path. No. 1504. This cyst contained clear fluid and was lined by several layers of squamous epithelium. It was probably an inclusion cyst.

On histological examination the vaginal mucosa over the surface of the cyst is usually normal, but, as might be surmised, it is often slightly atrophic over the most prominent portion. The cyst walls are composed of fibrous tissue; the inner surface is lined with a varying number of layers of squamous epithelium. Sometimes there is a uniform covering of from two to thirty layers of cells, but, as a rule, the epithelial lining is very thick at one part of the cyst and thin at a distant point. The superficial epithelial cells are often devoid of nuclei and are filled with vacuoles. The deepest layer is usually cuboidal (see Fig. 195).

The cysts contain desquamated squamous epithelium, detritus, and, at times, fat droplets and cholesterin crystals. Where the cysts are relatively large, the cavity is often partially filled with clear fluid. The cysts are usually single, but they may be multiple; in one case I have seen three irregular cysts separated by very slender partitions and lined by from two to eight layers of squamous epithelium.

As Stokes and others have so clearly pointed out, little doubt remains that these cysts originate from inclusions of the vaginal epithelium. Our observations substantiate this view. In twenty-four of our twenty-six cases, we were able to get a satisfactory history, and in every instance the patient had a lacerated perineum; in five out of the twenty-four the tear extended into the rectum. In every case where the site of the cyst was noted it was found either in the posterior or lateral wall, usually in the floor of the perineum.

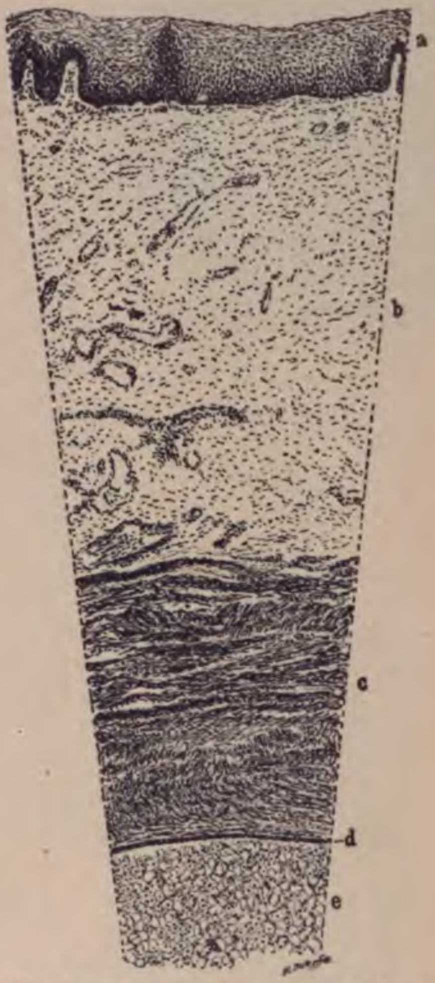


Fig. 195.—Section from the Wall of a Cyst, 2 by 2.5 Cm. in Diameter, taken from the Posterior Wall of the Vagina.

The walls are thin and transparent, and the cyst cavity is nearly filled with large cells. *a*, normal stratified squamous epithelium of the vaginal mucosa; *b*, connective tissue showing a number of small blood vessels; *c*, a layer of muscle fibers cut longitudinally and transversely; *d*, two, and in places three, layers of rather flat epithelial cells lining the cyst cavity. Other portions of the cyst are lined with several layers of typical squamous epithelium. *e*, large cells lying free in the cyst cavity, probably desquamated epithelium. Path. No. 1411. Magnified 50 times.

Cysts of Gartner's Duct.—As has been already pointed out, Gartner's duct in the fetus may in some instances pass from the parovarium down the side of or in the substance of the uterus to the cervix and thence obliquely downward and inward to the hymen (see Fig. 188). In the vagina its course may run just to the side of the urethra or in the lateral wall of the vagina. We also know that, while in the majority of cases this duct disappears, in a few instances isolated pieces persist in adult life. Such isolated links of the persisting duct may become cystic as a result of accumulated secretions. Numerous such examples are on record. If only one segment of the duct persist, a single cyst develops, but should five or six be present, we may have a corresponding number of cysts which, as we should naturally suppose, occur in a single row. The cysts may be exceedingly small, but as a rule they attain several centimeters in diameter. In rare instances they almost completely block the vagina. They naturally have an outer covering of vaginal mucosa, which, over the most prominent part, may be atrophic. The cyst walls are usually not more than 1 or 2 mm. in thickness. The inner surface of the cyst may be perfectly circular, but it is frequently oblong, and now and then a cyst is met with in which there is a small stem, as it were, leading off from the main cyst. Such a finding would demonstrate fairly conclusively that a portion of the duct has not yielded so readily as the rest to the process of dilatation.

The inner surface of the cyst may be perfectly smooth along its convex vaginal surface, and yet present a definite undulating surface on the opposite or fixed side, showing clearly an unequal dilatation and thus differing from an ordinary cyst.

Occasionally we meet with an oblong cyst where the tumor measures 8 by 5 cm. The inner surface presents a definite wavy appearance, being gathered up into large or small folds. The cysts are invariably translucent and contain a straw-colored or a pale fluid.

In eleven of our cases a dilatation of a portion of Gartner's duct appears to have been responsible for the cyst. In ten of these the position of the duct was ascertained. In the remaining one the anatomical peculiarities afforded a clue sufficient for the diagnosis. The most common situation was in the anterior vaginal wall near the urethral orifice.

As regards our ten cases the distribution was as follows:

In the anterior vaginal wall near the urethra, six cases.

In the right lateral vaginal wall, one case.

In the left vaginal wall, one case.

In the right vaginal fornix, one case.

In the left vaginal fornix, one case.

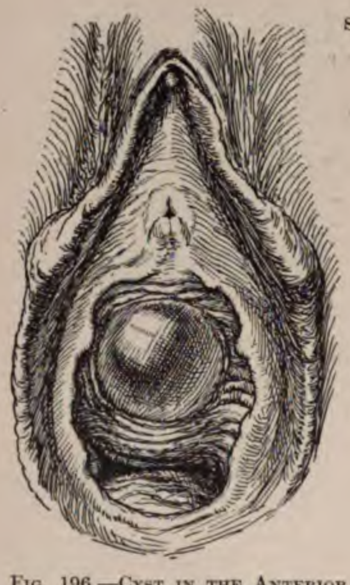


FIG. 196.—CYST IN THE ANTERIOR WALL.

Gyn. Path. No. 640. Situated beneath the urethra is a translucent cyst. On being dissected out this was found to measure 4.5 x 3.5 cm. Its inner surface was smooth and glistening and it was lined by one layer of flat cells. This cyst in all probability was a dilated portion of a Gartner's duct. (Cullen, *ut supra.*)

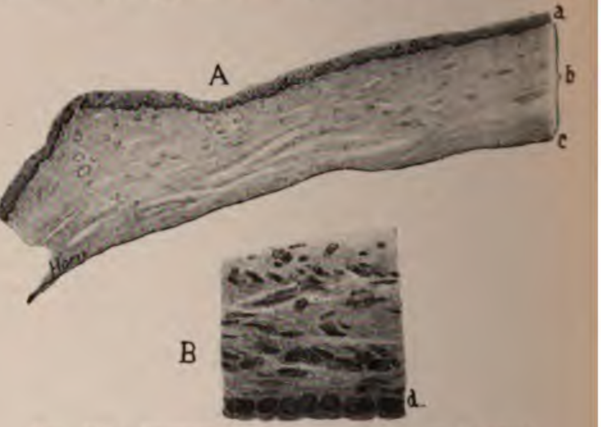


FIG. 197.—SECTION OF CYST OF ANTERIOR VAGINAL WALL.

Gyn. Path. No. 4644. A is a 15-diameter enlargement of the wall. The outer vaginal covering (*a*) is normal. The walls (*b*) are composed of fibrous tissue and the inner surface (*c*) has a delicate covering. B is a 480-diameter enlargement of a portion of A, and at *d* is seen the inner lining, composed of a single layer of cuboidal epithelium.

Fig. 196 is a characteristic example of a cyst situated just beneath the urethra. Only rarely do the cysts become pedunculate. Where the cyst is situated in the vaginal fornix the walls are liable to be considerably thicker as the duct lies more deeply imbedded in the tissue.

The cyst walls proper are composed of fibrous tissue; sometimes intermingled with these are bundles of non-striped muscle fiber. These were demonstrated in two of our cases. Where the cyst is small, it is often possible to make it out, but in those of large size, the muscle is so spread out that sections from various portions of the wall often fail to reveal it, although at other points it may be present. The inner surface of the cyst is lined with one layer of cylindrical, cuboidal, or almost flat epithelium (see Figs. 197 and 198).

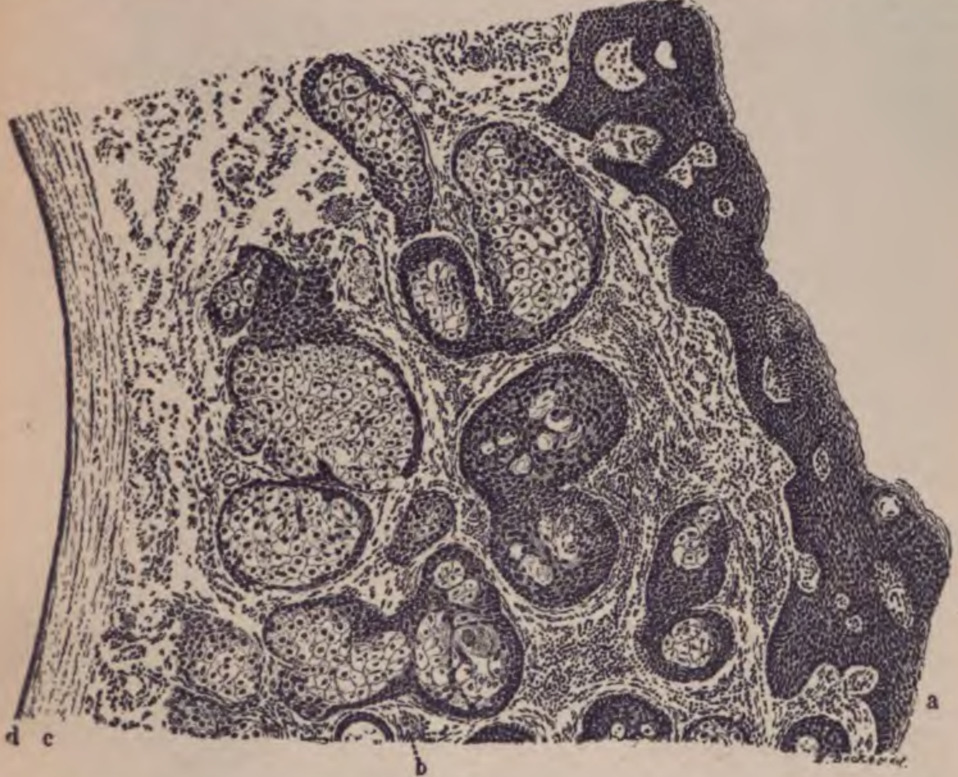


FIG. 198.—CROSS SECTION THROUGH THE WALL OF A CYST 1 CM. IN DIAMETER; THE CYST WAS FOUND SO NEAR THE EDGE OF THE VAGINA THAT ITS OUTER WALL IS SKIN.

At *a* the epidermis is normal, and scattered throughout the tissue are sebaceous glands, as seen at *b* and other points. *c* indicates spindle-shaped connective-tissue cells running parallel to the cyst wall. *d* shows the inner surface of the cyst lined by one layer of cuboidal epithelium. Path. No. 1390. Magnified 36 times.

Vaginal Cysts Arising from Urethral Glands.—If vaginal cysts ever owe their origin to urethral glands, such a condition is of very rare occurrence. The possibility, however, can not be excluded; in fact there were two of our cases in which various histological appearances justified the supposition that the tissue was very similar to, if not identical with, that of the urethra.

Gas Cysts in the Vagina.—Various names, such as colpohyperplasia cystica and colpitis emphysematosa, have been applied to this affection, which has been accurately described by von Winckel. The condition is usually associated with pregnancy and consists of small cystic dilatations occurring generally in the submucosa, but occasionally in the epithelium itself. On puncturing the cyst there is a report with the escape gas and the cyst collapses. Such cysts last only for a short time and t disappear.

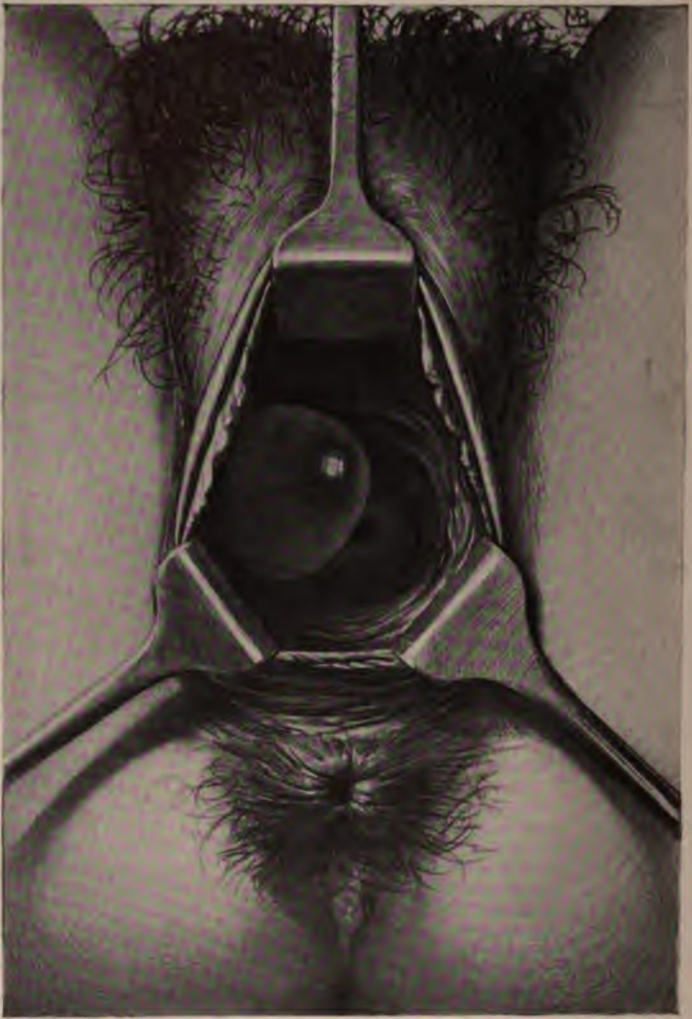


FIG. 199.—THIN-WALLED CYST OF THE RIGHT VAGINAL WALL.
The cyst is somewhat acuminate and the base is much smaller than the greatest circumference. P No. 428.

Von Winckel in 1886 reported three observations in pregnant women. I space that could be covered by a silver dollar he found fifteen to twenty cy e superficial and ent. The mucosa h they were em- vas hyperemic and t and the cysts ed with gas. On there was a loud h an escape of the Braun in 1861 similar instances. g to Eisenlohr the the affection must -producing micro- which stretches ph vessels and e lymph and the s into the sur- tissue. According- Strauss, as quoted the cysts were usu- ounded by connec- e, rarely by epi- Their occurrence be analogous to s cysts in the liver r organs, and we ot be surprised if ar future Welch's ogenes capsu- hould be proved causative factor. ment save punc- necessary, as the of short duration.

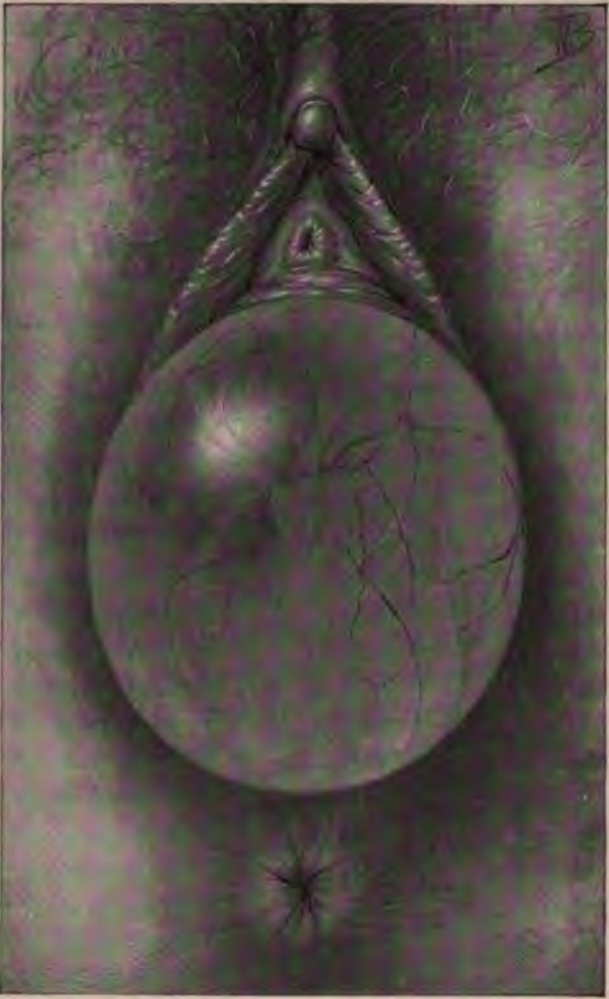


FIG. 200.—CYST OF THE ANTERIOR VAGINAL WALL OCCURRING IN PREGNANCY.

The entire cyst is translucent, with whitish bands interlacing over the surface. Note the well-defined blood vessels. Natural size. DEC. 9, 1895.

nococcus Cysts.—In countries in which the echinococcus is prev- ts may develop in the tissue between the rectum and the vagina. y project into the vagina and resemble vaginal cysts. If a doubt to their nature, a careful microscopic examination of the cyst contents vaginal wall will render the diagnosis clear.

ical History of Vaginal Cysts.—All of the cysts in our cases tively small and naturally gave rise to no symptoms whatever. In were detected during examinations undertaken for some other trouble, the case of inclusion cysts, during operation for perineal tears. Un- y many of the smallest cysts are overlooked, as in the ordinary routine laboratory examinations we have found some of which no account had appeared in the clinical record. Cysts 6 to 8 cm. in diameter partially block the vagina, and may interfere with coitus (see Fig. 199). If situated on the posterior wall they may roll out on the pelvic floor in such a manner that at first sight prolapsus of the vagina may be diagnosed, provided they are not translucent.

Cysts of the posterior wall have, in a few instances, formed an effectual barrier to delivery. In E. H. Peter's case, for example, the cyst contained about one pound of clear fluid, and had to be evacuated with the trocar before labor could proceed normally (*Monatschr. f. Geburtskunde*, 1869, Bd. 34).

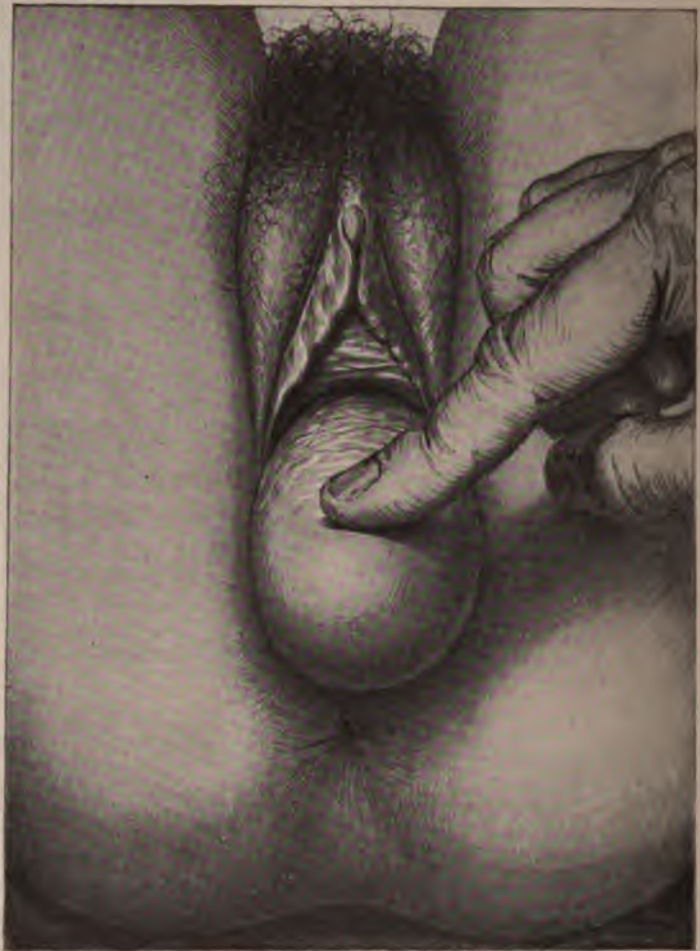
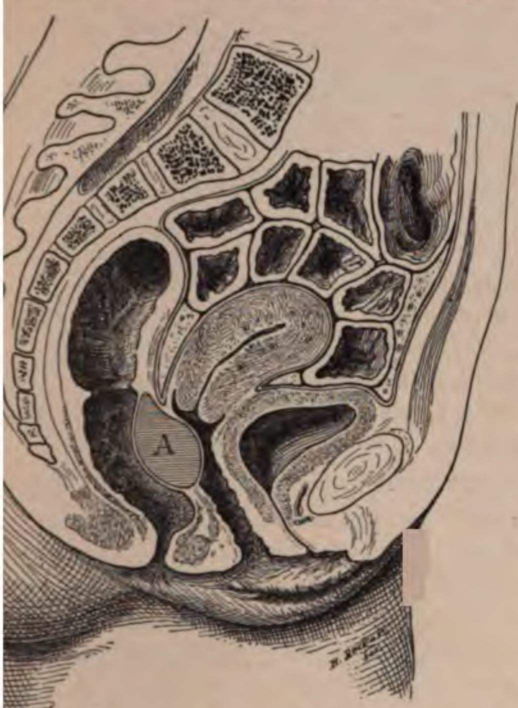


FIG. 201.—LARGE, THICK-WALLED CYST OF THE POSTERIOR VAGINAL WALL PROJECTING FROM T VULVA. SEPT. 14, 1894.

In the case of a vagino-parovarian cyst which is not full, mere pressur is sufficient to remove the obstruction, the fluid passing up to the parovariu and the vaginal portion collapsing into the flaccid pouch.

ginal cysts in the posterior wall may have to be differentiated from an
in the recto-vaginal septum (see Figs. 202 and 203). The cysts are not tender, while abscesses are painful; they are also of rapid development and accompanied by fever. I have seen purulent vaginal cysts five times, three of the anterior wall and two of the posterior, all of them extremely painful, sensitive to the slightest touch, and associated with fever. Two of those on the anterior wall, however, were not true vaginal cysts, but suburethral abscesses, discharging into the urethra; another, a suppurating vaginal cyst with a thin wall, was seen in consultation with Dr. A. K. Minich, of Philadelphia; it was situated within the vagina on its anterior wall, ovoid and as big as a hen's egg. It was cured
imple incision evacuating the pus. The fourth was 4 cm. in diameter
nches) and 3 cm. (1.2 inches) thick, situated in the posterior vaginal
igh up, just below the vault, and seemed fixed to a firm base. It caused
sms of agonizing rec-
n, during which the
would stand grasp-
chair and screaming.
cising it, thick, yel-
dorless pus escaped;
lls of the cavity were
, rigid, and irregu-
ove. There was no
nication with the rec-
n this case, as was
in an abscess of the
ginal septum re-
by Heydrich (*Cen-*
f. Gyn., 1891, No.



.—Abscess of the Recto-vaginal Septum (A) in the Upper Part of the Vagina.

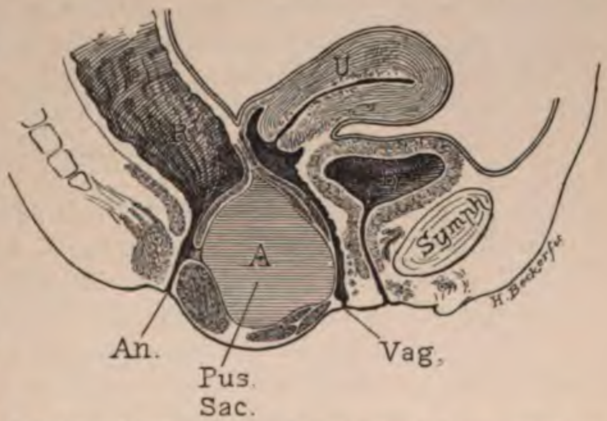


Fig. 203.—Abscess of the Recto-vaginal Septum from a Rectal Fistula, distending the Perineum and the Posterior Vaginal Wall.

21). The remaining case involved the posterior vaginal wall, low down, and was caused by a rectal fistula, so that out of the five, four were pseudo, and but one was a true vaginal cyst.

A vaginal cyst in the lateral wall may be mistaken for a blind vagina. The thick walls of the occluded and imperfectly developed vagina and the fact that the uterus is imperfectly developed will usually suffice to render the diagnosis clear.

Cysts of the vaginal vault must be distinguished from the atresia of a rudimentary horn of the uterus, which forms a prominent fluctuating tumor at the vault or extending from the vault down to the lateral wall. In these cases there is a history of pain associated with the retention, and a bimanual examination through rectum and abdomen will show that the tumor extends well up into the pelvis.

A suburethral abscess is peculiar in its position beneath the urethra, the thick vaginal wall covering it, its extreme tenderness, and in that it discharges its contents through the urethra on pressure.

A cystic dilatation of a blind ureter beneath the urethra may easily be confused with a simple vaginal cyst. Such was the case of E. G. Orthmann (*Centralbl. f. Gyn.*, 1893, No. 7). The cyst occupied the lower two-thirds of the vagina and increased in size each year. The diagnosis of a vaginal cyst was made, but on dissecting it out, it was found that the contents had disappeared, and on reaching its long pedicle above, a correct diagnosis was made of a forked ureter with a blind end dilated into a cyst.

Treatment.—The smaller cysts are excised and the resulting cavity sutured. Where the cyst is somewhat large and removal is difficult, half or three-quarters of the cyst, according to circumstances, may be cut off and the edge of the vagina united with that of the cyst on all sides. The remaining portion of the cyst thus becomes a part of the vagina and gradually unfolds until it is scarcely recognizable. Where the cyst is of the vagino-parovarian type, drainage or a combined abdominal and vaginal removal is necessary. It is, however, seldom wise to resort to an abdominal operation, unless there are pressure symptoms or the cyst is very annoying.

ABSCESS OF GARTNER'S CANAL.

I have seen a single instance of this rare affection. A young Jewish girl of about fifteen years, a patient of Dr. G. W. Guthrie, of Wilkesbarre, Pa., developed severe pain in the genitals with high fever, which continued for several days. A fluctuating sac was found extending from the vault of the vagina on the left side close to the cervix, down along the antero-lateral wall to the vestibule, to the left of and on a level with the posterior urethral wall, where it shortly opened spontaneously, discharging pus. I saw her afterwards in consultation with Dr. Guthrie, and was able to pass a probe through the external orifice clear up to the vault of the vagina, but not beyond.

The quickest way to effect a radical cure of such a case would be to pass in a probe and to lay the sac open throughout its whole length in the vagina so as to get good drainage.

NEOPLASMS.

BENIGN NEOPLASMS.

Benign neoplasms originating in the vagina are extremely rare, and the only forms found are the **myomata.**

The etiology of these tumors, as in those occurring in the uterus, is still unknown, though Veit, following Recklinghausen (*Hand. d. Gynäkol.*, Bd. I, p. 348), speaks of the possibility of their originating in Gartner's ducts.

Myomata appear in the vagina either as polypoid growths with long pedicles or as more diffuse rounded tumors with wide bases extending out into the connective tissue surrounding the vagina.

The symptoms depend upon the size of the growth and the obstruction of the vagina and pelvis. The patient may complain of a sense of weight in the pelvis, and tenesmus of the bladder, even with partial retention, may occur, as direct effects of the pressure. There may also be constipation and rectal tenesmus. Pain in coitus has been noted, and the tumor may at times attain a sufficient size to interfere with delivery.

With necrosis and gangrene of the tumor we find the added symptoms of profuse ill-smelling vaginal discharge, with an accompanying irritation of the surrounding parts.

The treatment is removal of the growth. Pedunculate tumors are easily amputated, the vessels controlled, and the base sutured, bringing the tissues evenly together. In the case of a larger tumor with a wide base it may be necessary to enlarge the vaginal opening by making lateral incisions, before the growth can be satisfactorily reached and removed. The way to remove sessile tumors is to make a linear incision through the overlying vaginal wall and then to enucleate the growth. The cavity remaining after such an enucleation may be closed completely by suturing the vagina after checking all hemorrhage. The opposed sides are kept together by packing the vagina with gauze, which is allowed to remain undisturbed for from four to seven days.

MALIGNANT NEOPLASMS.

Malignant neoplasms are represented by sarcomata and by carcinomata.

Sarcoma appearing in the vagina, according to Steinthal (*Virch. Arch.*, Bd. 140, p. 449) and Kolisko (*Wien. klin. Wochenschr.*, 1889), may be sharply divided into two classes. In young children they are usually polypoid in form and situated on the anterior vaginal wall, while in adults the sarcoma is usually a diffuse growth found in any portion of the vaginal canal.

When secondary to sarcoma of the uterus it appears first in the vaginal vault as a dark-bluish knobbed or polypoid outgrowth.

In children the first symptom noticed is a rounded or irregular berry-like tumor appearing in the vulvar cleft and accompanied by pain. Pain on micturition and constipation may be present. In adult patients a vaginal discharge usually makes its appearance early in the course of the disease, and there are at times slight hemorrhages from the surface of the growth.

There is a great tendency in all of these tumors to undergo necrosis, and this, together with the foul discharges, opens up an avenue for the entrance of an infection, which in the end often causes death. Cystitis and pyelonephrosis also often accompany the growth, as well as pyometra and purulent peritonitis.

The diagnosis in all of these cases must be made by a microscopical examination of the tumor, but in case of sarcoma it must be remembered that delay makes the prognosis more serious.

The treatment is by early and radical removal of the growth.

Four cases have been reported—two in children and two in adults—in which permanent recovery has followed removal.

The various methods of operating are similar to those described under the treatment of carcinoma.

Carcinoma of the Vagina.—Primary cancer of the vagina is rarely seen. Hecht (*Inaug. Dis. München,* 1891) found that a little over one per cent of cases of cancer in women was vaginal. In the majority of these cases the posterior wall is affected first. Out of eighteen cases cited by Olshausen of Berlin, thirteen involved the posterior wall. The disease usually appears in the form of a fungating mass of tissue, easily breaking down and bleeding. Another form appears as a granular ulcerated area, with hard infiltrated margins. In a still rarer form of carcinomatous infiltration the vaginal walls simply become rigid and contracted.

While primary cancer is rare, a secondary involvement from extension to the vaginal vault from a cancerous cervix is quite common—so common, indeed, that it is often necessary to remove a considerable part of the upper vagina with the uterus in hysterectomy for uterine cancer.

Nothing is known as to the cause of this affection. Heredity and trauma during childbirth have not been shown to be active, as in the case of cancer of the cervix. The tendency of the disease when located in the upper part of the vagina, is to extend over on to the posterior cervical lip, rendering it impossible at times to determine whether the cervix or the vagina was the original starting point. Where there is a large cancerous area at the vault of the vagina with an involvement of the outer surface of the cervix, which is continuous with it, the disease may without hesitation be stated to be vaginal in its origin instead of cervical.

Hemorrhages, vaginal discharge, dull aching pain, and difficulty in defecation and micturition are common symptoms. As the disease extends rapidly into the neighboring lymph channels, cachexia becomes more and more marked, until the patient dies of exhaustion.

The treatment is extirpation in all cases in which there is no involvement of the connective tissue laterally. Such an implication must be discovered by estimating the mobility of the diseased area through pressure directly upon it, and by palpating around its margins through the rectum.

There are in general four ways of operating upon a cancerous vagina:

First, a simple excision of the cancerous area through the vaginal outlet.

Second, a circular incision of the vagina below the diseased area, followed by a stripping off of the whole circumference of that portion which is to be extirpated; after this an abdominal incision, freeing the uterus and removing it with the upper part of the vagina.

Third, a transverse incision through the perineum, extending it on up through the recto-vaginal septum to the diseased area, which is then removed through the incision.

Fourth, a posterior incision from sacrum to fourchette beside the rectum, splitting the vagina up to the diseased area.

First, if the disease is discovered when it is still quite superficial and limited in its area, it may be extirpated with knife, or scissors and forceps, operating through the vaginal orifice and cutting around it on all sides at a distance of 1.5 or 2 cm.; after this it is loosened up from its base with the fingers and removed; finally, the margins of the wound are brought together by catgut sutures.

The second method consists in a circular incision of the vagina well below the disease; afterwards it is stripped up to the vault with the fingers and detached on all sides. The abdomen is then opened from above and the uterus and detached portion of the vagina removed. It is especially important here to determine that the vaginal infiltration does not extend into the surrounding tissues; careful examination must also be made through the rectum to discover any infiltration of the broad ligaments; should this be found a radical operation is contra-indicated. The operation may sometimes be concluded, after stripping the vagina loose posteriorly and at the sides as well as in front as far as the vault, by catching and drawing down the cervix and applying ligatures to the broad ligaments, and removing the uterus, as in vaginal hysterectomy. Sometimes the whole upper third of the vagina may be removed in this way.

The third method, proposed and used by Prof. Olshausen (*Centralbl. f. Gyn.*, 1895, No. 1), consists in the removal of the cancerous vagina through a transverse incision in the perineum, and a separation of rectum and vagina up to Douglas' *cul-de-sac*. If the uterus is to be removed, the peritoneum is opened, after which the uterus is inverted and freed by tying off the broad ligaments from above downward toward the cervix. When this separation is partly effected, the loosened vagina is cut through with scissors and the carcinoma detached, and finally, after releasing the bladder, the cervix uteri is tied off. If the uterus is not to be removed, the separation of vagina and rectum is carried up to the cervix uteri, and the vagina in the neighborhood of the disease is freed on all sides from the subjacent tissue. An incision is then made into the vagina at a suitable point and the diseased portion excised with scissors. In a contracted vagina the last part of the excision is facilitated by splitting its posterior wall from the frenulum up, giving a broad view of the field.

I prefer the fourth plan, extirpation by an incision beside the rectum, to this, as less awkward and as enabling the operator to reach the parts more directly, as in the following case.

The cancerous patch was situated at the vault of the vagina posteriorly; it was 3 by 4 cm. (1.2 by 1.4 inches) in diameter, and involved the outer surface of the cervix as well. The diseased area could not be drawn down, so as to attack it from below, so the patient was placed upon her left side, an incision made from the end of the sacrum, beside the coccyx, and continued in a slightly curved line down beside the rectum and around the right margin of the anus,

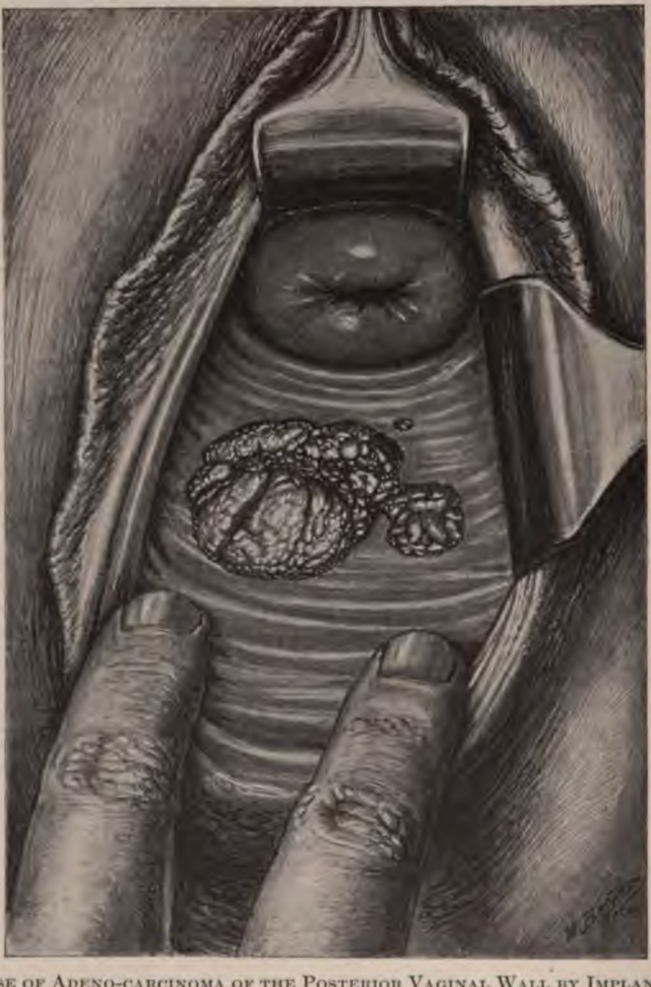


Fig. 204.—A Case of Adeno-carcinoma of the Posterior Vaginal Wall by Implantation from an unsuspected Adeno-carcinoma of the Body of the Uterus.

through the perineum to the fourchette. By carrying the incision deep enough the rectum was exposed and easily drawn toward the left with retractors, in this way exposing the vagina. The posterior vaginal wall was then split, from the fourchette to the cervix, the diseased portion freed at the sides with the fingers, and removed. It included the posterior two-thirds of the upper portion of the vagina and the posterior lip of the cervix above the vault. The uterus was now brought down in retroposition, and its posterior surface united to the vaginal wall, where it was cut off, filling in the gap left, and leaving a shortened but entire vaginal canal. The posterior wound was closed with interrupted sutures. The patient recovered, and the uterus united in its new position, but the disease, which had extended beyond the limits of the field of operation, continued to advance, and she died at her home some months later.

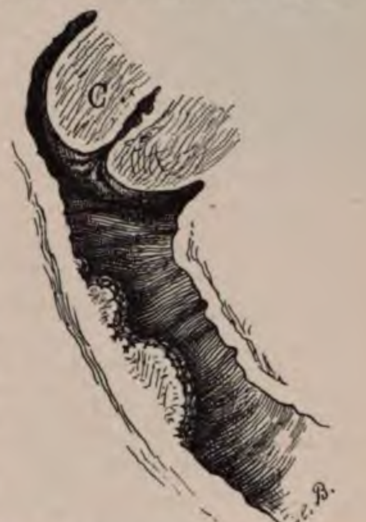


FIG. 205.—SECONDARY VAGINAL CARCINOMA.

Sagittal section of the cervix (*C*) and vagina, showing the isolated carcinomatous nodules on the posterior wall. Case same as Fig. 204. J. S., Nov. 14, 1895.

If the uterus is to be removed as well, the peritoneum may be opened at Douglas' *cul-de-sac*, the uterus drawn through the incision, and its broad ligaments tied off; then, using it as a tractor by pulling it well out of the wound, the vagina is made tense and easily outlined while the finger is engaged in freeing it from the tissues at the sides and from the bladder in front. As much of the vagina as is necessary may be removed with the uterus. Care must be taken not to wound the ureters, by placing bougies in them before beginning the operation. If the uterus is not to be removed, the peritoneum must be pushed up without opening it, and the vagina freed on all sides in the neighborhood of the diseased portion; it is then opened and the diseased area excised.

TRAUMATIC AFFECTIONS.

Traumatic Affections of the Vault, Orifice, and Canal.—Traumatic affections are frequently found in the vagina, the result of injuries incurred in labor. They are usually located either in the vault or near the outlet, and involve one or both sides, extending down or up in the axis of the vagina. Any marked narrowing of the vaginal canal due to cicatricial contraction between the vault or the outlet is unusual.

Extensive sloughing in the middle of the vagina may produce a concentric contraction, narrowing the caliber even down to complete closure (atresia vaginae), and followed by retention of the menses (hematocolpos and hematometra). The cicatricial bands radiating out from the sides of a vesico-vaginal fistula and narrowing the lumen of the vagina serve to illustrate another mode of the production of a vaginal stenosis.

The vaginal cicatrices may be classified under two general heads, corresponding also to the difference in etiology, viz., cicatrices whose direction is in the axis of the vagina, and cicatrices whose direction is transverse to the axis of the vagina.

Cicatrices of the first class in the axis are usually found at either extremity of the canal, and are associated, as stated, with a lacerated cervix or a ruptured outlet.

Cicatrices of the second class crossing the axis are the result of pressure and sloughs during parturition, or of syphilitic sores.

At the vaginal outlet the principal scars extend from the posterior median line up the right or the left sulcus on one or both sides of the posterior column. The scar tissue at this point must be regarded as a conservative effort of Nature in her endeavor to fill out and draw together the rents produced in childbirth. The symptoms produced by such scars vary from the slightest all the way to a severe neurosis. Rarely a scar is so tender as to require excision. A scar at the vault may be the cause of a lateral displacement of the uterus. Cicatricial contraction of the canal will interfere with all its functions, even rendering the escape of the menses impossible or endangering life in case of

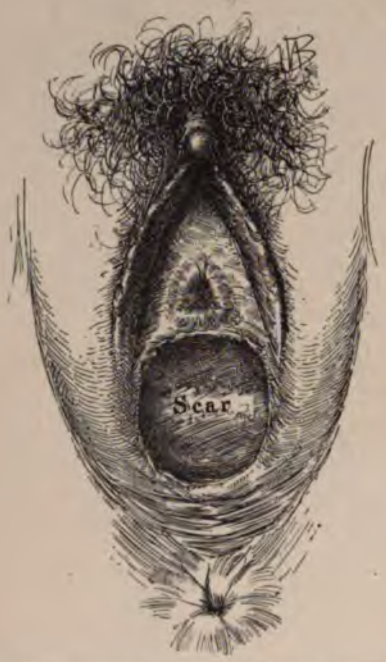


Fig. 206.—Atresia of the Vagina, showing the Scar at the Point at which the Anterior and Posterior Vaginal Walls come together. A. M., Jan. 18, 1896.

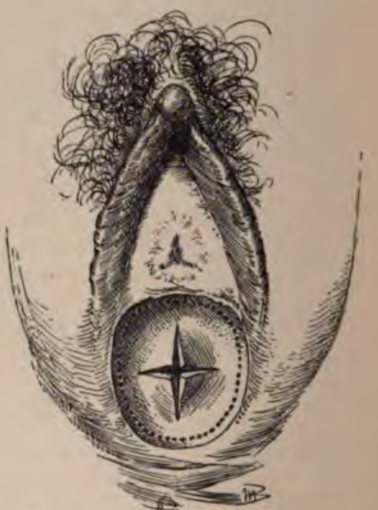


Fig. 207.—Operation for Atresia of the Vagina caused by an Adhesion of the Anterior and Posterior Walls in the Form of a Septum just above the Hymen.

The cruciform incision is made first to permit the thorough washing out of the sac; the dotted line indicates the area excised in restoring the caliber of the vagina.

pregnancy. Too much stress, however, must not be laid on this last point, as labor has progressed normally in such cases in which the outlook seemed almost hopeless at the start.

The treatment differs according to the form and extent of the disease. The best method, in general, is a complete excision of the scar extending well into the subjacent tissue, supplying the defect created by sliding over it the sound tissue from above and below.

Strictures.—Small falciform cicatrices at the vault of the vagina on the right or left side may be treated by drawing the cervix in the opposite direction with a tenaculum, making the scar tense, and cutting across it in several places down to its base. This may be done under cocain, and if the cutting is repeated several times, the cervix will finally be freed. If the cervix is torn deeply, as is usually the case, the cervical tear may be repaired and the scar excised at the same time. Care must be taken to avoid the mistake of simply removing that portion of the scar which projects into the vagina. The dissection must be carried well below the vault, removing all of the scar tissue. The chief dangers are of injury to a ureter which has been drawn out of its normal position, and perhaps caught in the scar tissue, and of cutting a uterine artery, which is also brought nearer the vault than normal.

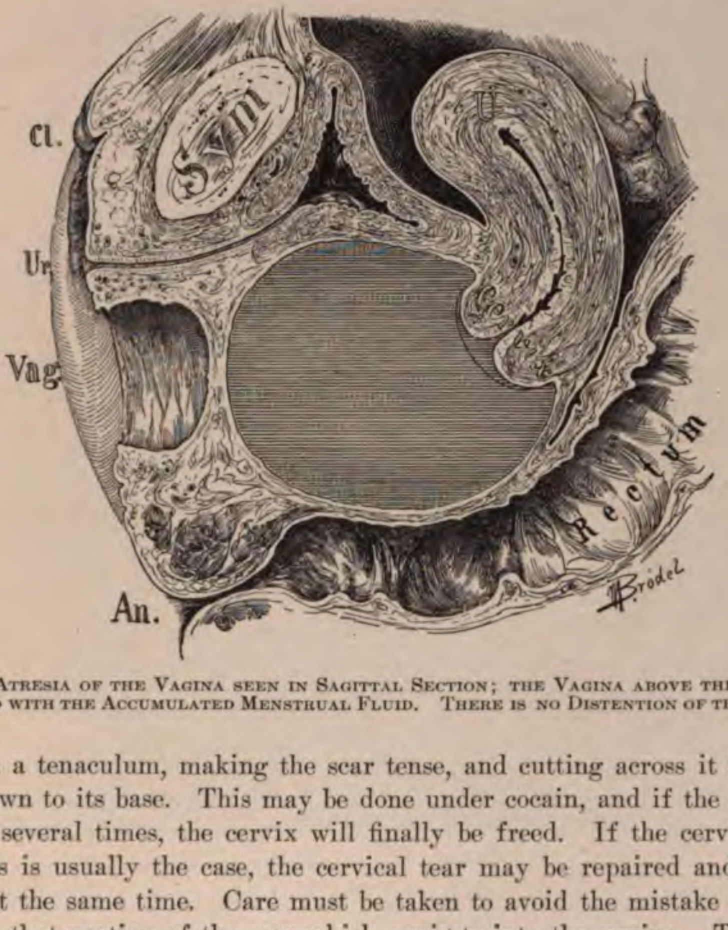


FIG. 208.—ATRESIA OF THE VAGINA SEEN IN SAGITTAL SECTION; THE VAGINA ABOVE THE ATRESIA IS DISTENDED WITH THE ACCUMULATED MENSTRUAL FLUID. THERE IS NO DISTENTION OF THE UTERUS.

To avoid injuring the ureter, a bougie should be placed in it before beginning any extensive operation at the vault. The ureter can then be readily felt from time to time, and if involved will be easily dissected out and restored to its proper place without injury.

The artery will be avoided by a slow, careful dissection, palpating the structures often as it progresses. The wound thus created is closed by interrupted sutures, and a dry dressing applied. Cicatrices in the lower part of the vagina are always removed in the course of the operation for relaxed vaginal outlet.

Atresia of the vagina following labor may involve any portion of the canal. The closure is due to sloughing from pressure during labor, followed by a cicatricial contraction. The area cut off may be from one to several centimeters in diameter. Oftentimes the atresia is incomplete, when a superficial examination would lead the observer to assert that it was complete. One or two minute orifices may be detected in the transverse scar at the bottom of the vaginal *cul-de-sac*, and pressure made above may cause a little dark fluid to exude.

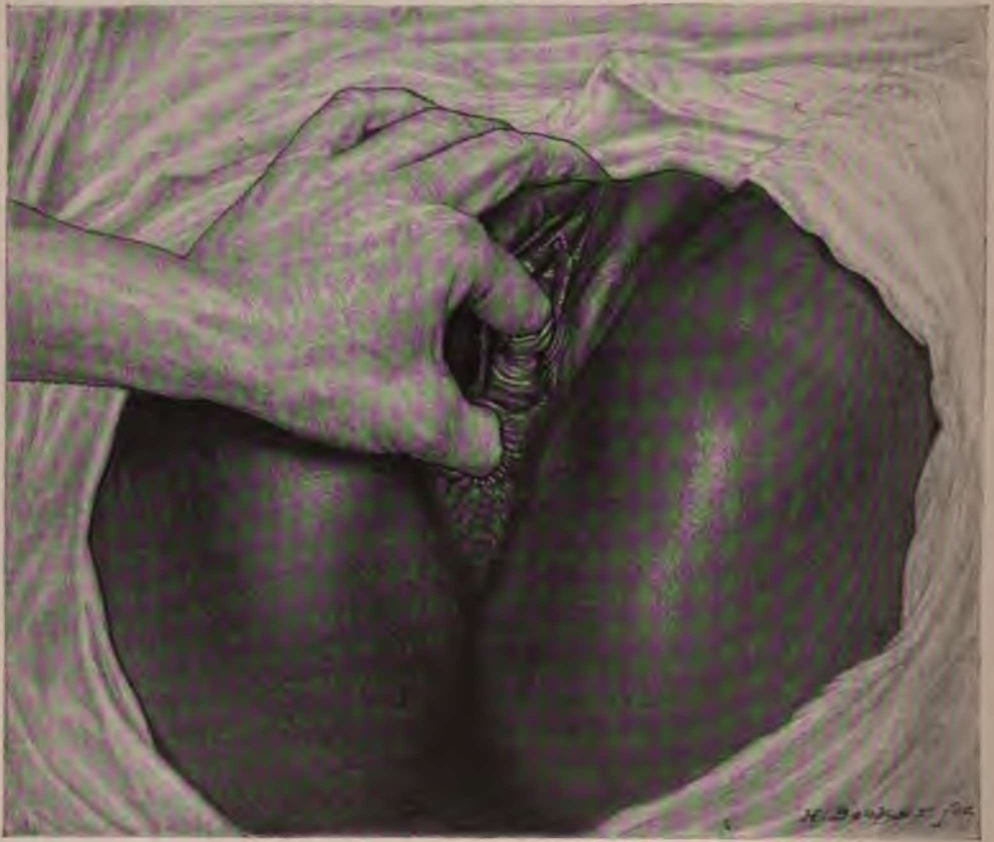


Fig. 209.—Atresia of the Vagina in a Negress.

The index finger is introduced through the dilated urethra into the bladder, and with the thumb in the rectum clearly defines the position and thickness of the recto-vesical septum. Only a shallow vaginal pocket is visible between the thumb and the finger.

The severest symptoms arise in atresia from the apparent amenorrhea, which might be called an amenorrhea parodoxica, as the menstrual function continues normally, while the secretions accumulate above the stricture. The pain at the menstrual period is often agonizing. With the increasing accumulation the vagina expands, and the cervix and uterus, and sometimes the uterine tubes, dilate, until the pelvis is choked, and a large mass may be felt projecting into the abdomen.

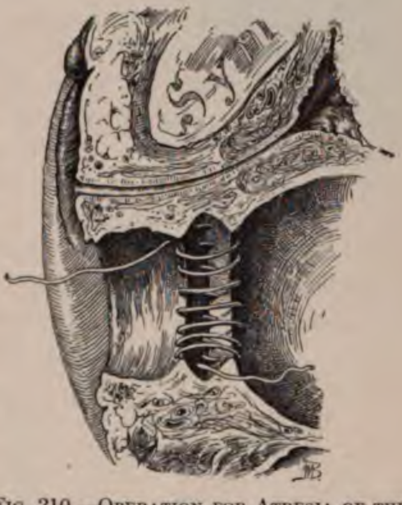


FIG. 210.—OPERATION FOR ATRESIA OF THE VAGINA SEEN IN SAGITTAL SECTION, SHOWING THE CONTINUOUS SUTURE APPLIED IN THE RIGHT HALF OF THE VAGINA, BRINGING THE VAGINAL MUCOSA ABOVE DOWN TO THE VAGINAL MUCOSA BELOW THE ATRESIA, IN THIS WAY BRIDGING IT OVER WITH MUCOUS MEMBRANE. (See p. 341).

Atresia may arise from extensive ulceration in the vagina, but the one common cause is the traumatism of a delayed labor in a contracted pelvis. From this condition one of my patients recovered, not only with an atresia, but with a vesico-vaginal fistula, and a recto-vaginal fistula as well.

The diagnosis is made by the history of a severe labor, by the subsequent amenorrhea with severe menstrual colic, and by the impediment to sexual intercourse. An examination reveals the nature of the affection, as the finger enters a short sac, or if the urethra is dilated, as is often the case, the finger may enter the bladder without difficulty, greatly puzzling the physician for a time.

An examination *per rectum* shows the presence of a fluctuating sac above the atresia, and above this, it may be, one or two other sacs, separated by one or two well-defined transverse constrictions.

The treatment is to remove the scar tissue which closes the vagina and to establish a permanent free communication between the separated parts of the vagina by a plastic operation; this is completed in three steps: First, opening up the channel and allowing the accumulated fluids to escape; second, removing the scar tissue; third, uniting the sound upper and lower portions of the vagina over the defect.

Before, throughout, and after the operation the most painstaking antiseptic precautions must be taken, as the accumulated fluid is peculiarly liable to undergo rapid decomposition, and the walls of vagina, uterus, and tubes are in a state of extraordinary susceptibility to infective processes. Death from infection has so often followed the simple evacuation of the fluid that many surgeons dread the operation.

I can not illustrate the further steps of the operation better than by describing one of my cases (*Johns Hopk. Hosp. Rep.*, 1894, vol. iii, p. 429).

The patient was a negress about twenty-two years old. She had had a still-born child after a prolonged instrumental labor eight years before I saw her, and had suffered ever since the birth. Her periods had always been regular before her confinement, but she had never menstruated since, although suffering greatly with the monthly molimina and from backache and pains in the lower abdomen. Six months before I saw her she had been kept in bed eight weeks by an attack of peritonitis.

On making a vaginal examination under a bed cover, the finger entered a large, smooth-walled cavity in which none of the expected landmarks could be recognized. This was found to be the bladder, with the urethra so widely dilated that two fingers could be introduced without pain; the external urethral orifice hung patulous and everted under the pubic arch. All that was left of the vagina on the vulvar side was a little pit of firm scar tissue 1 cm. in depth just behind the urethra.

Upon making a bimanual examination a chain of tumors was found filling the pelvis, lying one above another; at first they felt like a group of myomata,

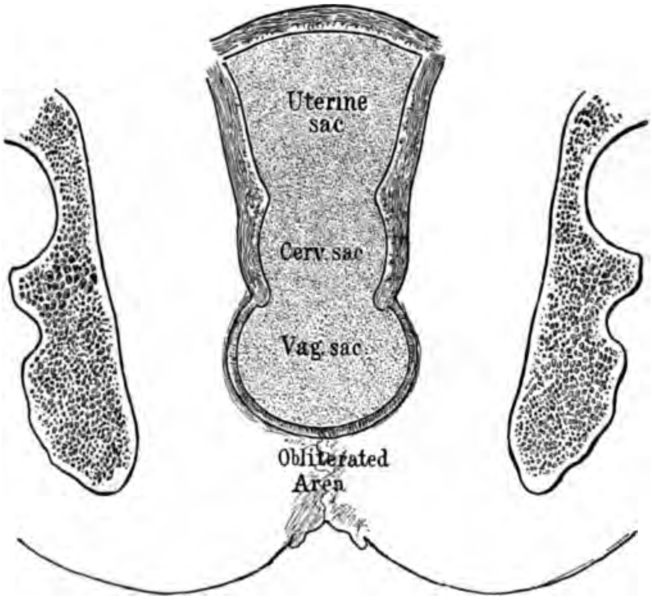


FIG. 211.—CORONAL SECTION OF AN OLD ATRESIA OF THE VAGINA WITH DISTENTION OF THE VAGINA, CERVIX, AND UTERINE CAVITY WITH MENSTRUAL FLUID. THE ATRESIA OCCUPIES THE LOWER THIRD OF THE VAGINA.

but a closer examination showed that they fluctuated and formed a continuous cavity, with two shallow sulci between. The obliterated portion of the vagina was 4 cm. long.

The operation was performed in this way: The left index finger was introduced into the bladder and the thumb into the rectum until they touched the sac of fluid and held the atresic area between their palmar surfaces. Using these fingers as a guide to avoid injuring the rectum or the bladder, a large trocar was introduced into the pit beneath the urethra and pushed up through the obliterated septum until it penetrated the sac. Upon withdrawing the trocar 500 c.c. (about 16 ounces) of tarry blood escaped and the three sacs collapsed. By means of a uterine dilator the trocar puncture track was now enlarged until it reached from one pubic ramus to the other. Abundant room was thus secured to catch the margin of the vagina just above the stricture and dissect it loose on all sides for a distance of a centimeter. This loosened collar was then pulled down over the dilated atresia and attached by a series of interrupted sutures to the margin of the vagina just below it. By this means, by sliding the normal vaginal tissue down over the cicatricial area, the canal was restored without leaving an exposed raw area to undergo subsequent contraction. The caliber of the new vagina was now normal, and a month later, when the patient was discharged, it even appeared normal in length.

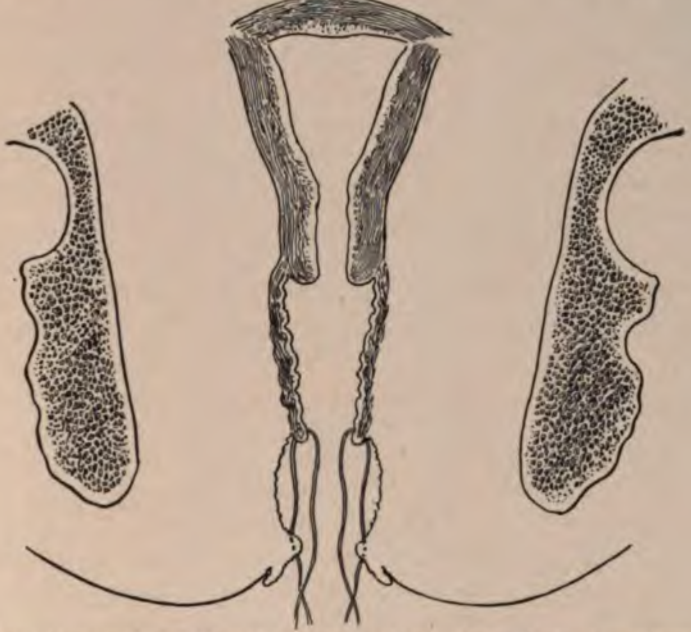


FIG. 212.—OLD ATRESIA OF THE VAGINA OPENED AND EVACUATED; INTERRUPTED SUTURES IN PLACE TO DRAW THE VAGINAL MUCOSA DOWN TO THE MUCOSA AT THE VAGINAL OUTLET, BRIDGING OVER THE DENUDED AREA IN THE CONNECTIVE TISSUE.

If resisting scar tissue is felt after opening up the canal, it must be dissected out. Where the urethra is not dilated, the finger in the rectum alone will serve as a guide for the trocar.

RECTO-VAGINAL FISTULA.

Recto-vaginal fistulæ are abnormal channels of communication between the rectum and the vagina, generally situated at one end or the other of the vaginal canal.

The cause of the fistula in the upper vagina is commonly an extension of a cancerous disease from the cervix on to the vagina and through the recto-vaginal septum; in the lower vagina the commonest cause is a failure in the attempt to restore a complete rupture of the recto-vaginal septum. After this operation, if the suturing is imperfect, fecal matter is apt to be forced into the upper part of the wound upon the denuded surfaces, producing suppuration and failure of union, and leaving a fistulous orifice opening either on to the vulva or into the vagina.

Other causes, such as syphilis and stricture of the rectum, produce fistula in some cases. I have seen but one case where it was due to labor. I have also seen one case where it followed the excision of hemorrhoids, and another where a necrosis had been produced by the pressure of a badly fitting pessary.

The symptoms arise from the escape of fecal material into the vagina, or, if the orifice is minute, from the escape of gases by this avenue.

The cancerous fistulæ are particularly distressing from the disgusting condition in which the patient is apt to be kept by the constant emission of feces from the vulva.

Fistulæ low down in the vagina are often so small that they are detected with difficulty, and yet the inability to control the gases, which escape audibly, keeps the patient in a constant state of nervous apprehension.

The diagnosis is made either by simple inspection, or by passing a probe into any suspicious pits and thus tracing the connection with the bowel, or by introducing the finger into the rectum and palpating its anterior surface from the sphincter up. The rectal end of the fistula is marked by a distinct depression easily felt; this can be pushed forward and the vaginal opening made visible.

A further demonstration may be made by injecting milk into the rectum and watching for its avenue of escape by the vagina. The patient herself often calls attention to her inability to retain rectal enemata, which escape by the vagina.

The proper treatment of a recto-vaginal fistula depends upon various associated conditions.

Fistula from the extension of cervical cancer is not, as a rule, amenable to treatment. The utmost that can be done is to keep the parts as clean as possible by securing a daily free evacuation of the bowel, avoiding the constant leakage, and by the frequent use of vaginal douches.

In event of a slow progressing cancer at the vault, it would be quite right to try to give some relief by making the fistulous opening large enough to establish a free communication with the bowel, and then to denude a circular strip on the vaginal wall below this and close the vagina with interrupted silkworm-gut sutures (partial colpocleisis).

There are three ways of closing a recto-vaginal fistula by suture:

First, by a funnel-shaped denudation of the edges on the vaginal side followed by suture, after the pattern of the vesico-vaginal fistula operation.

Second, by splitting the perineum and recto-vaginal septum and completely separating the rectal from the vaginal portion of the fistula, followed by a separate suture of the rectum.

Third, by splitting the recto-vaginal septum vertically as far as the fistula, which is then denuded and the recto-vaginal septum closed as in a case of complete tear.

Before operation the intestinal tract must be thoroughly emptied, the parts cleansed, the sphincter ani stretched so as to paralyze it, and a loose iodoform-gauze pack put well up in the rectum to keep its discharges out of the vagina and off from the wound during the suturing.

In determining what form of operation will be best in a given case, the position of the fistula, the condition of the surrounding parts, and the presence or absence of scar tissue must be considered. Any complication on the rectal side, such as a deep pit, an ulcer, or granulation tissue, must also be taken into consideration, as these conditions almost necessarily defeat union.

First. The simplest form of operation, a funnel-shaped denudation and suture, will be selected when the opening lies above the sphincter and levator ani area, when it is free from bands of scar tissue, and the rectal surface is healthy and does not present a deep pit. After suitable exposure the parts are benumbed with cocain applied for ten minutes. The area to be excised is then outlined with the point of a sharp knife about 1 cm. away from the edge of the opening on all sides. This area is now denuded by catching the edge with forceps or a tenaculum, cutting away strip after strip with a pair of delicate scissors until the whole is bared and bleeding down to the rectal mucosa, which now lies at the bottom of a wide-mouthed funnel opening on the vaginal surface. The wound is now closed by a series of interrupted silkworm gut sutures, three to the centimeter, passed in the direction of least resistance, generally from side to side, and tied firmly. Superficial catgut sutures are used between the silkworm gut if the line of approximation is not perfectly accurate. The gauze pack is now taken out of the rectum and the vagina washed out and a piece of iodoform gauze inserted loosely. The after treatment consists in a restricted diet and regular daily movements of the bowels, preferably secured by medicine taken by the mouth. In eight days the stitches are removed, and the patient may go about.

In one of my cases there was a small opening 3 mm. in diameter just beyond the internal sphincters, and the surrounding tissue was soft and natural and free from scars. I applied çocain, after which I denuded and closed it on the vaginal surface, as described, and allowed the patient to rise at once from the table and go home to continue her usual occupations without interruption. In eight days she returned, when I removed the silk sutures and found that perfect union had taken place. Such treatment as this will only succeed in the most favorable cases, and ought rarely to be tried. The proper after treatment of a simple fistula is to keep the patient quiet in bed for a week.

Second. When the fistula is up above the sphincter area and is su rounded by scar tissue, the best plan is to dissect the rectum free from t vagina, either by splitting the perineum from side to side and working up the fistula between rectum and vagina, or by raising a flap of vaginal tiss below the opening and dissecting it up to the fistula, which is then freed fr its vaginal attachments on all sides. Interrupted sutures are now pass through the muscular coats of the denuded bowel, avoiding the mucosa a closing the rectal opening. They are left long and brought out through fistulous vaginal opening, which need not be closed. The incision in the rec vaginal septum, through which the separation was made and the sutures pass is finally closed, and a dry dressing placed in the vagina.

The success of this procedure depends upon the invariable soft, yield condition of the bowel, which is well adapted for plastic union when detacl from the rigid cicatricial vaginal tissue, that prevents the sides of the wou from coming together without undue traction.

I succeeded in one case (K. S., No. 2916, Sept. 5, 1894) in doing th where the rectal fistula was 2 cm. long, at the top of an obliterated upp vagina, with a vesico-vaginal fistula directly opposite. There was a la amount of scar tissue on all sides, rendering union by suture after denudat a hopeless undertaking. I therefore made a transverse perineal incision 4 c long and dissected between the vagina and rectum up to the fistula, which w then split, making two fistulous orifices out of one, the posterior opening le ing into the rectum and the anterior into the vagina. The rectal opening w then closed separately by interrupted fine silk sutures brought out throu the vaginal opening. The perineal wound was closed, and the result w immediate union throughout.

Third. When the fistula is low down, close to the vaginal outlet in sphincter area, the better plan is to cut entirely through the septum, rep ducing the complete rupture, and then to denude the fistula along its margi and for some distance above it, closing the whole as in a case of complete tea This is better than an attempt to effect closure by a denudation on the vagin side alone, for three reasons: In the first place, the position of the openi on the rectal side is unfavorably situated, as in any bowel movement unusu pressure is brought to bear on the anterior wall of the rectum at this point the fecal masses, and is so great that some particles of fecal matter are ine tably forced into the wound, preventing union. In the second place, there always a pit on the rectal side in these sphincter fistulæ which catches fe matter. In the third place, the bridge of tissue below the fistula which operator endeavors to save by simple denudation and approximation is of insignificant; this is especially apparent after it has been cut through.

I would repeat the caution not to forget to carry the denudation on vaginal surface well above the fistula. The further denudation and sut must be made as fully described in the treatment of complete rupture of recto-vaginal septum in Chapter XV.

CHAPTER XVII.

AFFECTIONS OF THE URETHRA AND BLADDER.

Brief historical sketch (p. 345): Celsus: calculus. Fatio: vesico-vaginal fistula. Simon: dilatation of the urethra. Grünfeld: introduction of light into bladder. Rutenberg's air-pumping speculum. Nitze's cystoscope for examining the male bladder modified for the female. Pawlik's method of catheterizing the ureter free-handed. Sänger: palpation of the ureters. Kelly: examination under atmospheric distention induced by posture. Bibliography.

Topography of the bladder in women (p. 348): Natural landmarks within the bladder. The relations of the bladder to surrounding structures. Artificial division into hemispheres and quadrants.

Examination of the urethra and bladder (p. 351): Urinalysis and examination of discharges; percussion; palpation; inspection without instruments; urethroscopy; cystoscopy: Fundamental principles; instruments used—the light, the reflector, vesical specula with obturators, dilator, evacuator, ureteral searcher. The cystoscopic examination: asepsis; preparation of patient; anesthesia; postures, dorsal and knee-breast; calibrating and dilating the urethral orifice; the lubricant; introducing the speculum; inspection.

Diseases of the urethra (p. 367): 1. Malformations: hypospadias; epispadias; atresia of the urethra; totally deficient urethra. 2. Displacements: prolapse of the mucosa. 3. Dilatation. 4. Stricture. 5. Ischuria. 6. Fistula. 7. Foreign bodies. 8. Urethritis: acute; chronic; (1) diffuse chronic urethritis; (2) circumscribed chronic urethritis. 9. Suburethral abscess. 10. New growths: caruncle; fibroma; myoma; cancer; sarcoma.

Diseases of the bladder (p. 398): 1. Introductory. 2. Diagnosis: by history and symptoms; by urinalysis; by palpation; by inspection under illumination. 3. Methods of treatment in general. 4. Classification of diseases: Congenital defects: (1) Double bladder; (2) loculate bladder; (3) exstrophy. Displacements: (1) lateral; (2) upward; (3) downward; (4) eversion. Foreign bodies in the bladder: (1) Calculi, pessaries, catheters, etc.; (2) removal—through urethra; through vaginal incision; through suprapubic incision. Vesical fistulæ: (1) Historical sketch: Luiz de Mercado, Felix Plater, Hendrick Roonhuyzen, J. Fatio, A. J. Jobert, G. Simon, J. Marion Sims, T. A. Emmet, Nathan Bozeman, A. Martin, L. von Dittel, A. Mackenrodt, W. A. Freund, E. C. Dudley, H. A. Kelly; (2) causes; (3) symptoms; (4) diagnosis; (5) Treatment, (*a*) general, (*b*) of fistula of large size: A. Martin—closure by turning up vaginal flaps to form the new base of the bladder; F. Trendelenberg—closure by transplanting a flap from the posterior vaginal wall; E. C. Dudley—closure by suturing the denuded vesical mucosa to its anterior margin; A. Mackenrodt—closure by detaching the bladder from the vagina and suturing it independently; H. A. Kelly—closure by detaching the bladder posteriorly and suturing it to the denuded vaginal wall anteriorly; W. A. Freund—closure by suturing the body of the uterus into the defect, (*c*) of vesico-utero-vaginal fistula: H. C. Coe, Otto v. Herff, H. A. Kelly, F. Trendelenberg, (*d*) of vesico-uterine fistula: F. H. Champneys, H. A. Kelly, (*e*) of other vesical fistulæ: G. C. Blackman. Hemorrhoids. Hyperemia. Cystitis: (1) bacteriology; (2) acute; (3) chronic; (4) treatment of chronic cystitis—medication, irrigation or instillation, direct topical treatment, surgical treatment; (5) tubercular cystitis; (6) exfoliative cystitis.

Tumors of the bladder (p. 468): 1. Classification. 2. Benign tumors: Papilloma; fibroma; adenoma; myoma; cystic follicles; dermoid cysts. 3. Malignant tumors: Epithelioma; myxoma; sarcoma. 4. Clinical history of vesical tumors. 5. Diagnosis. 6. Operative treatment: By a dilated urethra; by vaginal incision; by suprapubic incision; by symphyseotomy; cystectomy; K. Pawlik's case.

HISTORY.

PREVIOUS to the latter half of the nineteenth century but little was known t diseases of the urinary apparatus in women.

And while the relatively more urgent and dangerous diseases of the male organs had exacted the closest attention, the modesty of women, as well as the inaccessible nature of the affections, conspired to hinder an earlier scientific investigation of their genito-urinary organs.

The shortness of the female urethra was known, and special metal catheters suitable for its investigation were devised and used before the Christian era; Celsus in the first half of the first century carefully describes an operation for stone in the bladder in women—cutting for the stone from the outside through the vestibule into the neck of the bladder, cautioning the operator to insert the finger, as a control, into the vagina in a married woman, but into the rectum in a virgin. Calculus in the female therefore attracted attention at an early date, on account of the surprising observation that enormous stones could safely pass through the short and more easily relaxed female urethra (*quæ et brevior quam in maribus et laxior est.*—Celsus).

Johannes Fatio, of Basel, late in the seventeenth century recognized, treated, and cured cases of vesico-vaginal fistula by denuding the margins with scissors and drawing the edges together with a sharpened quill wrapped with thread.

A new interest was aroused in diseases of the bladder by the labors of G. Simon, of Rostock, who carefully determined the extreme degree of safe dilatability of the urethra for digital palpation of the bladder, using a series of conical dilating specula with obturators, their diameters increasing up to 20 mm.

Simon was also able in some cases to feel a ureteral orifice, and, under the guidance of touch, to slip in a ureteral catheter; he did this seventeen times in eleven cases, but never made any practical use of it. Indifferent as was Simon's success, this was the starting point of all recent important work in connection with the diagnosis of affections of the female urinary organs.

Josef Grünfeld, of Vienna, in 1874, filled the bladder with water and then examined it through a short, straight speculum, with a piece of glass set obliquely in its tube, so as to prevent the escape of the fluid and at the same time to permit the direct passage of light without reflection.

Rutenberg devised a speculum, about 20 mm. in diameter, with a glass partition and a tube attached for injecting air into the bladder, while a mirror placed inside the bladder reflected various parts of its walls. It was necessary to anesthetize the patient to relieve the pain produced by this examination, and Rutenberg never succeeded in finding the ureteral orifices.

Max Nitze, of Dresden, with real genius, constructed a cystoscopic apparatus for the male bladder, consisting of a long tube-like catheter with a short beak, carrying a small electric lamp at the tip and a prism at the eye through which the light, reflected from the walls of the bladder distended with water, is directed into the tube, which further contains a telescopic arrangement of lenses providing a wide field of vision for the observer at the outer end. A larger, shorter, and straighter tube has been made after the same plan for use in women.

Through this elaborate and delicate but most useful instrument, Nitze and his followers, who are now to be found among the genito-urinary specialists in all the larger cities, are able to examine not only the bladder but also the ureteral orifices, and even to catheterize the ureters with a flexible catheter, introduced in a small tube beside the speculum. Nitze himself is also able even to operate successfully upon small tumors within the bladder.

K. Pawlik, of Prague, made one of the most important additions to this subject when he improved Simon's ureteral catheter for women, and demonstrated the feasibility of introducing it free-hand into the ureter through the urethra and bladder. This is done by retracting the posterior vaginal wall while the bladder is moderately distended with water (150 to 200 cubic cm.), when the two "ureteral" folds come into view on the anterior vaginal wall, sweeping backward from the neck of the bladder toward the cervix and marking the site of the ureters just above them. These folds determine the direction of the tip of the catheter in the bladder as it is made to glide along its base while seeking the ureteral orifices. The finger at once recognizes the fact that the catheter has become engaged in the ureter by its assuming a certain fixed direction.

M. Sänger, of Leipzig, added another fact of the highest importance when he pointed out the ease with which the lower ends of the normal ureters could be felt through the vaginal walls, and the increased distinctness of enlarged diseased ureters.

My own method was first published in the *Johns Hopkins Hospital Bulletin* for November, 1893, and in a longer and more fully illustrated article in the *American Journal of Obstetrics* for January, 1894. Its essential features are:

1. An atmospheric dilatation of the bladder induced by posture.

2. The introduction of a simple straight speculum, as a rule of small size and without fenestra.

3. The examination of the mucous surface of the bladder and urethra by means of a reflected light or an electric headlight.

I have furthermore demonstrated the ease with which flexible catheters can be introduced into the ureters in this position, and by their use I have been able to reach the pelvis of the kidney, and to diagnose accurately such renal diseases as hydronephrosis, pyelitis, calculus, etc.

The whole field of investigation of bladder, ureteral, and renal affections is in this way thrown open to easy investigation.

Since the publication of my method K. Pawlik has described a modification of it consisting in a dilatation of the urethra under anesthesia sufficient to admit a large open speculum, the atmospheric distention of the bladder, and its examination by means of a little electric light introduced into the bladder through the speculum (*Central. f. Gyn.*, May 5, 1894).

But few treatises devoted to urinary diseases in women have as yet appeared. Scanzoni's, in 1854, was the first. A. J. C. Skene's book on "Diseases of the Bladder and Urethra in Women" was published in New York in 1882; F. Winckel's elaborate and valuable contribution appeared in Billroth and Luecke's

"Handbuch," Stuttgart, second edition, 1886; H. A. Kelly's "Diseases of the Female Bladder and Urethra," "Twentieth Century Practice," William Wood & Co., was issued in January, 1895; and finally we have "Die Krankheiten der weiblichen Blase," by H. Fritsch in Veit's "Handbuch der Gynäkologie," 1897.

TOPOGRAPHY OF THE BLADDER.

The fact that we are now in possession of a simple means of observing all sorts of bladder affections characterized by changes of form or color, thus bringing under observation and within the reach of local treatment even minute lesions, emphasizes the need for other and more accurate ways of describing the location, form, and extent of such diseases in their relationship to the bladder wall, as well as of registering such changes as may be found from examination to examination. It is also important, if we would convey any accurate impression of our observations to others, to use a more precise phraseology than such vague generic anatomical terms as "vertex" and "base," and to substitute in their place an accurate schema of the interior of the bladder with suitable divisions and subdivisions.

I will therefore consider the topography of the bladder from three standpoints, each of which will be useful to the specialist in describing what he sees through the speculum:

1. The natural landmarks within the bladder.
2. The relations of the bladder to surrounding structures.
3. An artificial division into hemispheres and quadrants.

1. The Natural Landmarks in the Bladder Itself.—The internal orifice of the urethra, which begins as a narrow margin to shut in over the end of the speculum, and continues to increase in breadth as the speculum is slowly withdrawn from the bladder, forms one of the most important points of departure in the description of lesions which may extend from the bladder into the urethra, or vice versa, or in the location of lesions limited to the area adjacent to the urethra; we have in this way a periurethral area circumscribed by a circle of say about 4 cm. in diameter around the internal urethral orifice.

"Opposite the urethral orifice" is also sometimes a convenient expression to designate the location of an affection involving the small area of the posterior vesical wall, the part first seen on withdrawing the obturator.

The ureteral orifices are the most important of all the natural landmarks in the bladder, and any account of a lesion in their immediate neighborhood is readily described as located either between them (interureteric) or posterior, anterior, or lateral, to one or the other.

In the knee-chest posture the ends of the ureters often stand out prominently, forming a truncate cone from 5 to 8 mm. in diameter at the base, and from 3 to 4 mm. high, with the orifices at the top or a little to the anterior inner side; I have named this eminence the mons ureteris; it is a valuable landmark in the accurate location of minuter lesions directly about the orifices.

I have given the name "ureteral folds" to marked rounded elevations in the vesical mucosa, about 2 cm. (¾ inch) long, sometimes seen in the knee-breast position, stretching from each ureteral orifice backward and outward toward the pelvic walls. These folds manifestly correspond to the terminal portions of the ureters which pass through the bladder wall. When the rest of the bladder expands with air the resistance of the firmer tissue of the ureters causes the elevation.

The vesical triangle, or trigonum (see Fig. 37; and also Plate VII, Fig. 1), with its three apices at the ureters and the internal urethral orifice, defines an area about 2½ cm. (1 inch) wide at the base and 2 cm. (¾ inch) long on the sides, easily distinguished by its deeper injection from the rest of the bladder mucosa. This is one of the most important landmarks, and as an area it is peculiarly susceptible to certain affections rarely found elsewhere.

The interureteric ligament, connecting the ureteral orifices, is sometimes seen as a distinct fold elevated above the level of the bladder behind it; it is usually marked as a line separating the deeper injection of the trigonum from the paler mucosa of the posterior part of the bladder.

A shallow depression 2 or 3 cm. (about 1 inch) broad is sometimes seen posterior to the interureteric line, and is formed by the bladder ballooning out in the direction of the vagina, while the less yielding trigonum resists the expansion.

Important points of reference also are those relating to the fixed and the movable portions of the bladder. As the bladder is emptied, the upper, more movable portion, covered with peritoneum, settles down into the lower and relatively more fixed portion, which lies in close relation to the vagina, until it comes to lie within it as one saucer rests in another. During respiration the free upper half may often be seen moving on the lower half, as if hinged, and the line of demarcation between them may be distinctly made out. This difference between mobility and relative immobility seems to determine to some extent the localization of the inflammatory affections.

At the edges where the two saucers meet, three folds are formed which can be most easily seen by examining a patient in the dorsal position, even without any, or with but little, elevation of the pelvis. I call these folds the plicae vesicales right, left, and posterior. The posterior fold stretches from side to side in front of the uterus; it is gently convex forward, and ends in front of each broad ligament, where each lateral fold begins, and extends horizontally around toward the urethra. These folds represent the physiological hinges on which the bladder moves in expanding and collapsing. I have called the apices where the posterior fold meets the lateral folds in front of the broad ligaments the right and the left vesical cornua.

2. **Relations of the Bladder to Surrounding Structures.**—To the specialist a familiarity with the exact relationships existing between the bladder and its enveloping structures is of the highest importance, on account of the liability

of the bladder to be affected by or to participate in the diseases of these structures.

The upper half of the bladder is covered with peritoneum, and may be called the subperitoneal area. This does not include an area above the urethral orifice, in relation to the space of Retzius and the symphysis pubis —the symphyseal area.

The trigonum and a broad strip of tissue extending back from it lie in close relation to the anterior vaginal wall—the vaginal area of the bladder. Just above this vaginal area is a narrow strip in close relation to the anterior portion of the supravaginal cervix uteri, as far up as the internal os, the uterine area. Laterally the two broad ligaments lie in contact with the right and left cornua.

3. Artificial Division of the Bladder into Hemispheres and Quadrants.—When the bladder is distended with air it forms a hollow sphere, flattened anteroposteriorly, and the observer, looking through the speculum, simply peeps through a hole in its wall, and by turning the speculum brings all parts, even those nearest the speculum, into view.

From the observer's standpoint it is easy to consider the bladder simply as a mathematical figure, a sphere divided into hemispheres. For example, the sagittal plane of the body which divides the pelvis into right and left halves, also cuts the bladder into right and left hemispheres by an imaginary line easily and accurately followed by simply elevating and depressing the handle of the speculum.

A point opposite the end of the speculum in the fully distended bladder, with the patient in the knee-chest position, in the center of the posterior hemisphere, may be taken as a posterior pole, corresponding to the internal urethral orifice, the anterior pole.

The position of the posterior pole determined in this way is not always in the same horizontal meridian, even in the same patient at different examinations; it is, however, always in the same vertical plane, and near enough the same horizontal position for practical purposes, so that, after assuming a certain point, as the posterior pole, and describing any lesions near by in relation to it, the same point is easily located at a later date for further comparison.

With a fixed posterior and an anterior pole, we may then consider the bladder as further divided by a horizontal plane passing through these poles. The sagittal and the horizontal planes, intersecting at the poles, further subdivide the bladder into quadrants.

Lesions at and around the posterior central point we may speak of as polar and circumpolar; lesions above or below the horizontal plane and to the right of the sagittal plane are described as located in the right upper or lower quadrants, and on the left side as in the left upper or lower quadrants.

By using this simple, but purely artificial scheme an irregular patch of disease can be accurately mapped out on a diagram, and any alterations in its form easily noted from time to time.

The chief use of this system of division is to locate lesions in the posterior part of the bladder, where no natural landmarks are readily available.

EXAMINATION OF THE URETHRA AND BLADDER.

There are, in general, four ways of making a physical examination of affections of the urethra and bladder, namely, by:

1. Urinalysis.
2. Percussion.
3. Palpation.
4. Inspection; urethroscopy, cystoscopy.

1. **Urinalysis.**—The fullest physical, chemical, microscopic, and bacteriologic examination of the urine should be made in every case where any morbid changes are found.

The color, odor, and specific gravity must be noted, together with the degree of alkalinity or of acidity, and the presence of albumin, sugar, pus, blood, mucus, or fragments of stone; minute stones may be seen under a weak lens and tested micro-chemically; the microscope may reveal pus corpuscles and blood, even in minute quantities, as well as casts and various crystalline substances. Bacteria must be noted, and identified as far as possible by the various staining and culture methods. Bits of tissue and epithelial cells may also be discovered. The bacteriologic examination of an uncontaminated specimen of urine will sometimes reveal at once the true cause of disease, such, for example, as the tubercle bacillus, gonococcus, or colon bacillus.

As a rule, in inflammatory diseases of the urethra, sufficient secretion may be brought to the meatus for a cover-slip examination by stroking it from above downward on its vaginal surface. After exposing the inner surface of the bladder to view in the manner to be described, secretions clinging to the bladder wall, or issuing out of a sinus, or from a ureteral orifice may be taken up on a platinum loop for further examination.

2. **Percussion** is of use in outlining a bladder full of urine or one containing air. If percussion over the lower part of the abdomen above the symphysis yields everywhere a tympanitic note, it is certain that the bladder can not be more than moderately distended with urine. When there is a decided fluctuating swelling just above the symphysis extending even as high as the umbilicus, a flat percussion note all over the enlargement, with a corona of resonance above and at the sides and a broad dull base below, almost surely indicates an overdistended bladder.

After examining the bladder under atmospheric distention, upon withdrawing the speculum, the overlying abdominal wall yields a high-pitched, tympanitic note on percussion until the air is discharged.

3. Palpation.—Valuable information can often be gained in urethral and vesical diseases by the sense of touch alone. Changes noted in this way relate to sensitiveness and to variations in form or consistency. The urethra is palpated indirectly through the anterior vaginal wall by rolling the index finger over it from side to side, pressing upward, and using the under and the posterior surfaces of the symphysis pubis as a point of counter-pressure. An inflamed urethra feels tense and swollen, and pressure upon it elicits a cry of pain; a suburethral abscess feels like an elastic round lump projecting into the vagina; a cancerous urethra is hard and fixed like a rigid cord, and often nodular.

The external urethral orifice is best felt with the index finger pressing up onto the symphysis just over the vaginal outlet. An inflamed orifice or a sensitive caruncle makes pressure intolerable; a cancerous orifice is hard and ragged. If the urethra is excessively dilated, as from coitus in atresia of the vagina, the finger may go into the bladder so easily as to produce the impression that it has entered a capacious vagina.

By palpating the empty bladder bimanually between two fingers in the vagina and a hand pressing down over the symphysis (see Fig. 272, page 455), the fingers can be brought close together, with only the abdominal wall, vagina, and upper and lower walls of the bladder intervening; by carrying the fingers back in the direction of the cervix, the posterior margin, where the empty bladder is reflected on itself, is often distinctly felt as it slips forward from under the touch. In cystitis pain is felt on making this pressure; in advanced tubercular cystitis the thickening in the bladder walls is easily appreciated. In one of my tubercular cases the bladder was felt firmly contracted down behind the symphysis, and big and hard like a hen's egg (see Fig. 272).

A stone or a foreign body may be caught between the fingers and outlined, and a diagnosis made in this way.

A still better way to palpate the bladder bimanually is by putting the patient in the knee-chest position and letting air into the vagina, when the fingers of both hands can be brought close together and the whole organ felt with wonderful distinctness. The time has forever gone by for dilating the urethra to admit the index finger for the purpose of palpating the inner surface of the bladder. No useful information can be gained by this crude procedure which can not be better secured, without pain and risk of incontinence, by the simple method of inspection.

4. Inspection.—In almost all affections of the urethra and bladder direct inspection yields the most positive results in the diagnosis of disease. An inspection without the use of any instrument may afford much valuable information. Almost all the affections of the urethral orifice may be diagnosed by an inspection, in which nothing more is done than to separate the labia minora wide enough to expose it. By placing a finger close to each side of the urethra and drawing its lips apart, the lower end of the canal is exposed to view, including the orifices of Skene's ducts posteriorly and just within them. By retracting the vaginal outlet, the vaginal surface of the urethra and of the floor of the bladder are seen, and a tumor of the urethra projecting into the vagina, or a displacement of the bladder, or a vesico-vaginal fistula may be recognized. Such marked displacements as a cystocele or a prolapse of the vagina and bladder are best observed when the patient stands erect.

When the abdomen is opened the peritoneal surface of the bladder is exposed to view, and anything affecting it, such as adhesions, or tumors pressing or growing upon it, or a hypertrophy, are easily seen.

Urethroscopy.—When a urethral or a vesical disease is far enough advanced to call for an investigation, there will almost always be found morbid changes distinct enough to be recognized by a cytoscopic or a urethroscopic examination.

The urethra is examined by introducing into the bladder a speculum 8 or 10 mm. in diameter and withdrawing it gradually, all the while studying the urethral mucosa as each successive part of the canal passes over the end of the speculum from above downward. At first the end of the speculum coming out of the bladder just clears the rim of the internal urethral orifice, then on continuing the withdrawal the rim approaches the center, forms the central figure, and then disappears from view as the lower walls successively come to occupy the field.

The endoscopic picture resembles a flat funnel, and, as suggested by Grünfeld, is so named; the portion in the middle where the urethral walls meet is called the central figure, and the portion of the urethra exposed to view between the central figure and the rim of the speculum is the funnel wall.

The central figure forms a large free opening only at the internal urethral orifice, where, surrounded by a narrow margin of mucosa, it is at first almost as large as the speculum; it decreases in size as the speculum is withdrawn, until the walls approach on all sides and form a small quadrilateral or oval figure, finally closing altogether; lower down in the urethra the central figure forms a transverse line, which finally assumes a vertical direction at the external urethral orifice.

The funnel walls are made up of numerous folds which radiate out from the central figure to the margin of the speculum. From eight to twelve of these may be seen at once. The posterior fold in the upper part of the urethra is the largest and is a continuation of a triangular elevation on the trigonum in the bladder, named by J. C. L. Barkow colliculus cervicalis. Numerous delicate vessels are plainly visible on the urethral walls, one or two on each fold, running longitudinally with it.

In the lower part of the urethra, near the external orifice, the longitudinal folds are crossed by a transverse fold, which subdivides the urethral mucosa into a kind of lattice work with shallow pits between.

The orifices of the urethral glands, Morgagni's crypts and Littré's acinous glands, appear as fine points, often in groups disposed longitudinally, or as larger yellowish spots; they can be better seen by changing the position of the speculum so as to displace the central figure and bring one side of the urethral wall flat against its end.

One of the best methods of examining the outer portion of the ureter, and especially the orifices of Skene's glands, is by bending two hairpins as shown in the figure (Fig. 213), and grasping them with forceps and using them to draw the labia and walls of the urethra apart.

Cystoscopy.—The fundamental principles of a cystoscopic examination are:

1. The introduction of a simple cylindrical speculum into the bladder.
2. The atmospheric distention of the bladder induced solely by posture.
3. The illumination and inspection of the vesical mucosa, either by means of a direct light, such as a little electric lamp attached to the forehead or the mouth of the speculum, or by means of a strong light reflected by a head mirror.

The view of the bladder obtained in this way is a direct one; and the open speculum allows the operator to touch any part of the bladder with a sound, and to introduce various instruments with ease.

The Instruments Used.—The necessary instruments are the following: A strong light, a head mirror, vesical specula with obturators, a urethral calibrator and dilator, an evacuator for removing urine, long mouse-toothed forceps, and a ureteral searcher.

In case of emergency the instruments absolutely necessary for an examination are few and simple. The light is always easily obtained, and every physician owns a throat mirror. An evacuator can be made by attaching a piece of rubber tubing to the end of a syringe; and the dilator, forceps, and searcher can be dispensed with, so that the vesical speculum is really the only novel indispensable instrument, and even that could be extemporized from a piece of tin or a bit of cardboard.

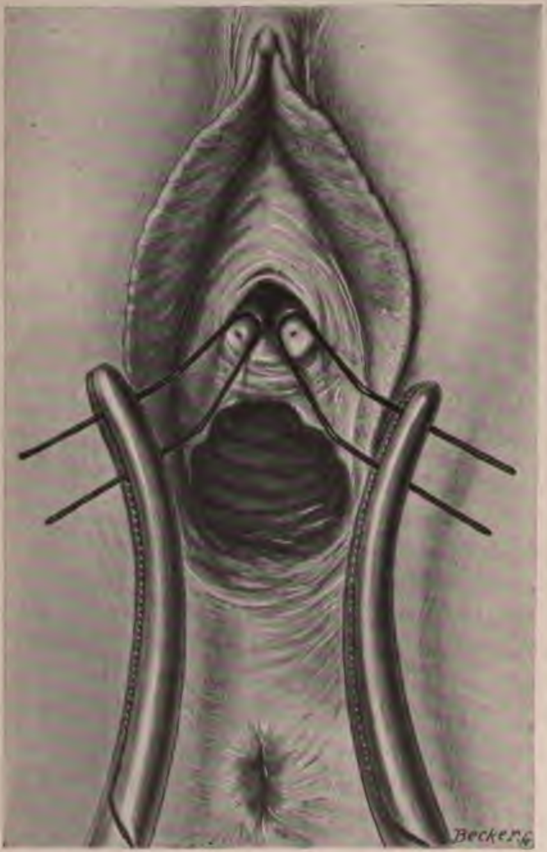


FIG. 213.—BENT HAIRPINS GRASPED IN ARTERY FORCEPS AND USED AS A SPECULUM TO EXPOSE THE ANTERIOR PORTION OF THE URETHRA, MORE PARTICULARLY THE ORIFICES OF SKENE'S GLANDS.

The Light.—The best illuminant is the strong white electric light. I commonly use a sixteen-candle-power droplight set in a socket on a short wooden handle, with a simple oval tin reflector, evenly coated with white enamel paint on the inside, covering half of it; the current is conveyed from the wall by cords, and the connection with the wall is made by means of a movable socket; it is ready for use at any moment, and can be carried from room to room.

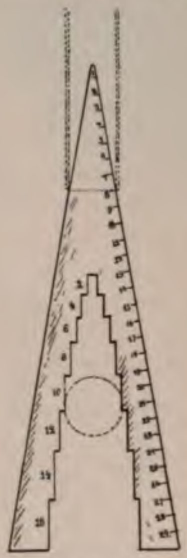


FIG. 214.—GRADUATED INSTRUMENT FOR MEASURING CALIBERS AND DIAMETERS OF SPECULA.

The caliber is measured by inserting the end into the speculum as far as it will go and reading off the size on the scale. The diameter is measured by dropping the speculum into the graduated opening and reading off the size. By deducting the caliber from the diameter the thickness of the wall is measured.

When there is no electric light available, I take with me a small storage battery weighing ten pounds and measuring 10 by 6½ by 4½ inches, which runs a six-volt four-candle-power mignon lamp for fifteen hours. The little light is attached to the head band and inclosed in a short metal cylinder with a reflector behind it. A tube carrying a convex lens fits over the cylinder, covering in the light, and moves on a ratchet, affording an adjustment which concentrates the illumination on a small circle at the desired point. If a direct electric current is available, the battery can be recharged without sending it away, by connecting it with the wires from the street, with a current adapter interposed.

Strong daylight or sunlight gives a good illumination, but, although at times invaluable, it is uncertain, and it is awkward to direct it to all parts of the bladder, which necessitates moving the patient about instead of the mirror.

A short candle may be used, but its light is too feeble for a minute examination. Lamps and gas burners are the most unsatisfactory light, because they can not be held close enough to the patient, and they give out sufficient heat to make the examiner uncomfortable.

The head mirror is a simple concave reflector with about 30 cm. (12 inches) focal length. The large circle of light which is thrown by this mirror around the orifice of the speculum is a necessity, for, if the circle were a small one, the slightest movement of the head would darken the field in the bladder, while the larger circle allows considerable latitude of movement.

I like the mirror attached to a flexible steel band crossing the top of the head better than the elastic bands encircling it; the steel band is more quickly put on and removed without disarranging the hair. A steel segmented band covers and protects the mirror when out of use, and is the safest and most convenient device for transportation.

The Vesical Specula.—The specula are simple cylinders 8 cm. (3⅕ inches) long, and equal in diameter throughout; they are preferably made of German silver and nickel plated. There is a funnel-shaped expansion at the outer end of the speculum 15 mm. long, inclined at an angle of sixty degrees to the cylinder. The handle, 8 cm. (3 inches) long and 12 mm. broad and 5 mm. thick, is attached to the funnel and is large enough to afford a convenient grasp which does not tire the hand during a prolonged examination.

My first specula were furnished with handles so small that they had to be held between the thumb and the index finger. The handle used after this is seen in Fig. 216. I now prefer handles about twice this size, or even as large as that shown in Fig. 215.

The vesical end of the speculum must be rounded in toward its lumen, and under no circumstances must a ragged or a knife edge be left to cut the mucosa.

Specula are made in various numbers ranging from 5 to 20, each number representing the diameter of the cylinder in mm.—5, 6, 7, etc., up to 20; the specialist will also find it convenient to have on hand the following half sizes: $6\frac{1}{2}$, $7\frac{1}{2}$, $8\frac{1}{2}$, $9\frac{1}{2}$, $10\frac{1}{2}$, $11\frac{1}{2}$. The sizes below No. 12 are used for examination, and those above to secure a wide lumen in operations upon the bladder.

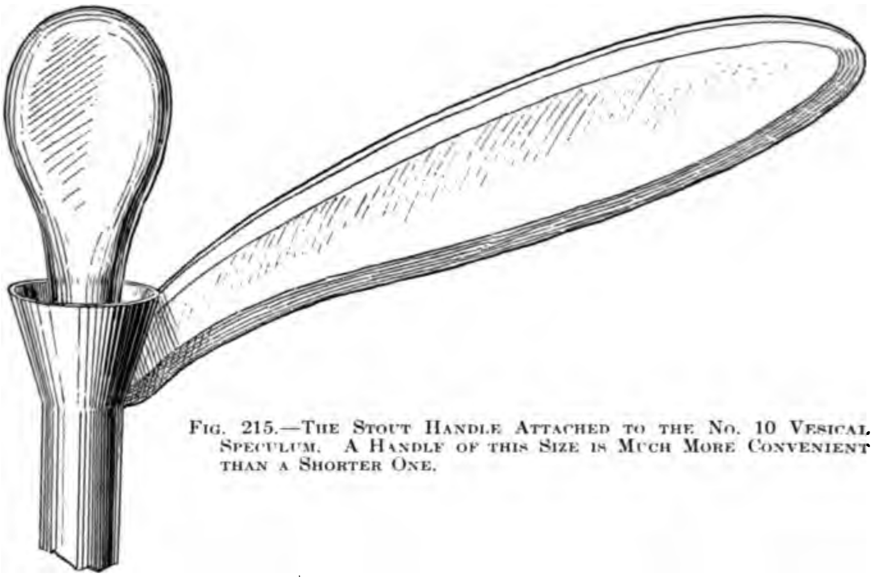


FIG. 215.—THE STOUT HANDLE ATTACHED TO THE NO. 10 VESICAL SPECULUM. A HANDLE OF THIS SIZE IS MUCH MORE CONVENIENT THAN A SHORTER ONE.

Each instrument has its **obturator**, only used for the purpose of rounding out the end of the speculum during introduction; the obturator consists of a conical end piece connected by a slender shank to a stout handle which fits into the funnel of the speculum.

The shank of the obturator is made stout enough not to bend in withdrawal, and the handle is large, so as to give a good hold for the thumb and index finger.

To facilitate the introduction of the cystoscope there must be no shoulder to injure the urethra between the end of the speculum and its obturator.

The dilator is a conical instrument 7 cm. (3 inches) long, with a blunt point 3 mm. in diameter; it is 16 mm. in diameter at its base. It is graduated from point to base in millimeter diameters from 4 to 16 mm. A handle attached to the base is large enough to afford a convenient hold for three fingers, and a flange at the base keeps it from slipping all the way into the urethra.

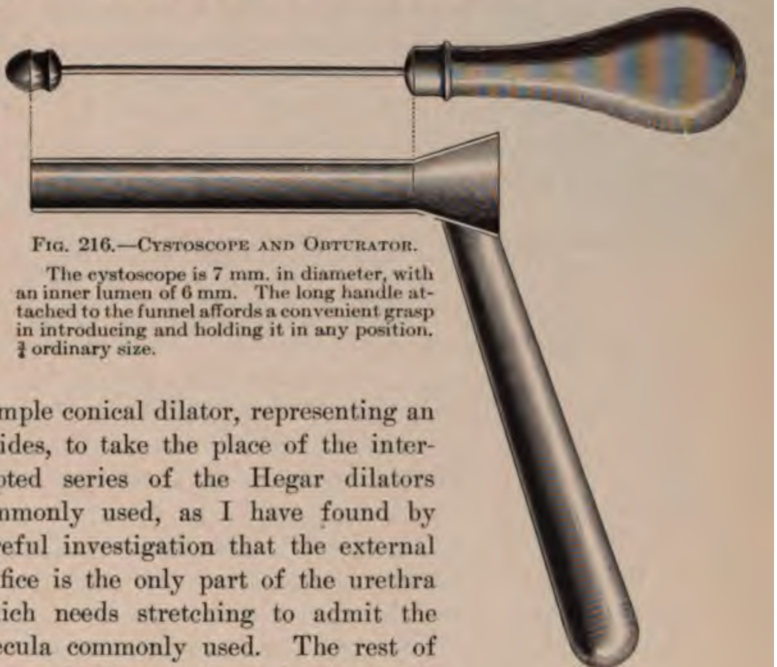


FIG. 216.—CYSTOSCOPE AND OBTURATOR.

The cystoscope is 7 mm. in diameter, with an inner lumen of 6 mm. The long handle attached to the funnel affords a convenient grasp in introducing and holding it in any position. ¾ ordinary size.

I have devised a simple conical dilator, representing an infinite series on its sides, to take the place of the interrupted series of the Hegar dilators commonly used, as I have found by careful investigation that the external orifice is the only part of the urethra which needs stretching to admit the specula commonly used. The rest of the urethral canal is so elastic that it yields at once to the obturator and opens up to the full size of the speculum without previous dilatation and without injury.

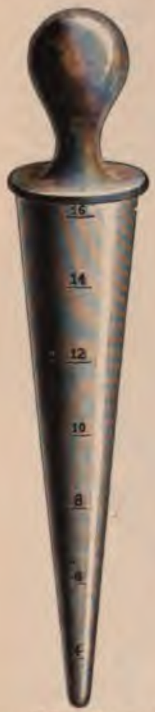


FIG. 217.—URETHRAL CALIBRATOR AND DILATOR.

The numbers indicate the diameters in millimeters.

The evacuator is used to empty the bladder of the residual urine which the patient often can not expel, and which can not be removed by a catheter, amounting to 4 to 10 c.c. It must also be used from time to time to remove the urine accumulating during a prolonged examination. The evacuator is a small, hollow, perforated metal ball, connected by fine rubber tubing, about 35 cm. (14 inches) long, with a rubber exhausting bulb. The rubber tube is cut about 5 cm. (2 inches) from the ball, and a piece of glass tubing inserted which serves both as a telltale to show when the urine is flowing in the tube, as well as to give rigidity to the tube when it is picked up for introduction into the bladder.

If the patient lies on her back during the cystoscopic examination, the evacuator must be used much oftener, as a small quantity of urine easily obscures the field of view in this posture. In the knee-chest position, on the other hand, a little clear urine in a pool in the inverted vault of the bladder in no way interferes with a thorough inspection of all parts.

The evacuator is used in the following manner: The assistant, grasping the rubber bulb, pushes its base in with his thumb, and forces out all the air; while the examiner, holding the other end, drops the little perforated ball through the speculum into the pool of urine, when the assistant removes his thumb, and the bulb slowly expands, sucking up the urine. The evacuation will be more rapid if the suction bulb is held well below the level of the bladder. If there is only a little urine to be taken up, it will escape faster by withdrawing the ball a little occasionally so as to suck up some air with the urine.

Dr. G. E. Shoemaker, of Philadelphia, has devised a simple evacuator consisting in a little tube with perforations, slightly bent at both ends, and connected with an exhaust bottle emptied by a syringe (see *Annals of Surgery*, November, 1895). Dr. Garceau, of Boston, has made an attachment for the cystoscope to effect the same end, publishing the description of it a week or two in advance of Dr. Shoemaker.

The alligator forceps like those shown in Fig. 218 are lightly made, with long shanks, for use through the No. 8 speculum and larger sizes. It is best to have the mouthpiece at the end as shown, making them more efficient in grasping a foreign body in the bladder. They are useful in cleansing the lumen of the speculum from drops of urine, or in taking up a little urine out of the bladder with small pledgets of cotton, or in wiping off small areas of the vesical mucosa.

The ureteral searcher is a small rod 18 cm. (7 inches) long with a little bulbous end 3 mm. by 1.5 mm., and a handle 6 cm. (2½ inches) long set at an angle of 120 degrees. It is used in touching any part of the bladder wall, in exploring a sinus, and particularly in locating the ureteral orifices in doubtful cases.

Applicator.—Any piece of flexible wire about 15 cm. long will do as an applicator to carry medicated cotton to all points on the bladder or the urethra.

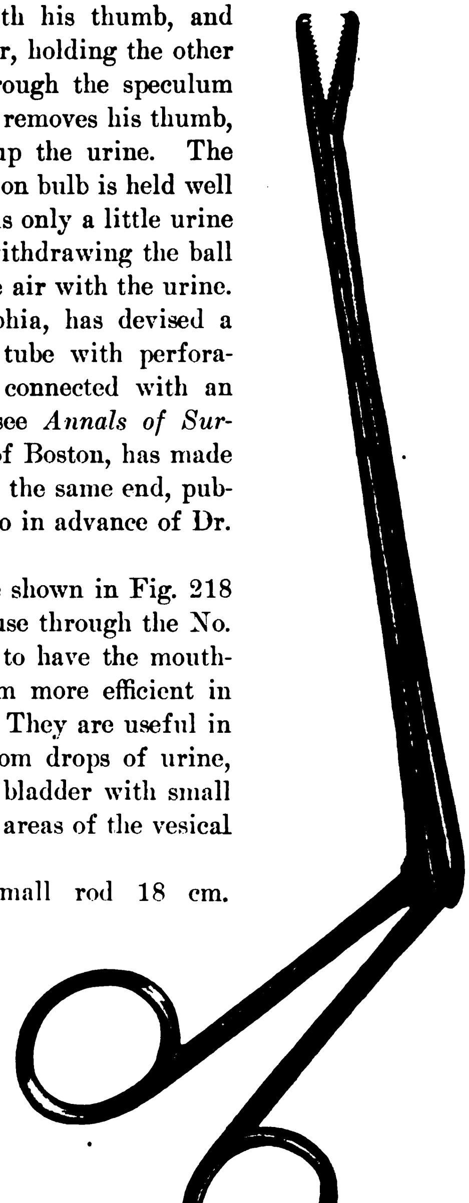


Fig. 218.—Alligator Forceps Used to Carry Pledgets of Cotton into the Bladder to Wipe off Pus or Clots of Blood, or to Cleanse and Sterilize the Urethral Orifices Before Catheterization, or to Dry Out a Little Residual Urine. Any Small or Elongate Body Like a Piece of Catheter can also be Readily Grasped and Removed with these Forceps.

Other useful instruments are a speculum graduated in centimeters for measuring the distance between points on the bladder wall, the external or internal urethral orifices, and a flattened searcher, likewise graduated in centimeters and half centimeters.

The Technique of the Examination.—*Asepsis.*—Asepsis must be maintained throughout every examination by handling only *aseptic instruments*, introduced by *clean hands*, through a *cleansed urethral orifice*.

All the instruments used must have been sterilized and must be laid in a clean tray on a sterilized towel. The external urethral orifice must be wiped clean with a boric acid solution, before introducing the speculum, to remove any leucorrheal or other discharges which often contaminate its lips.

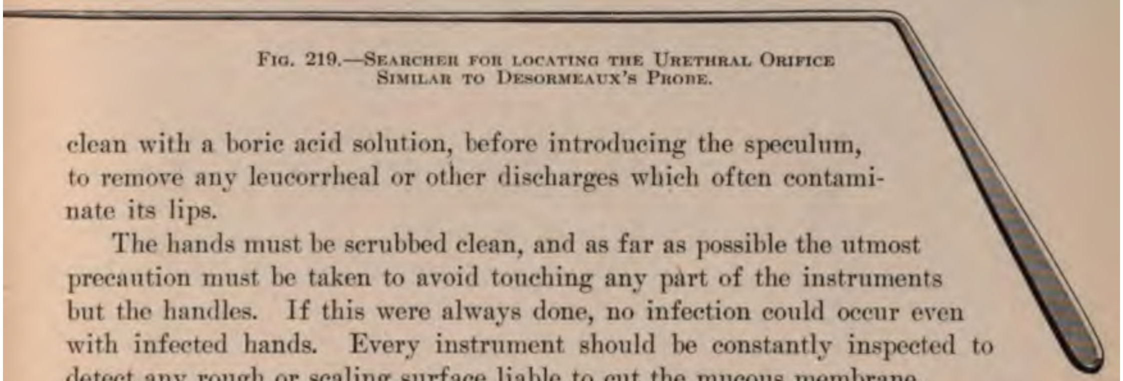


FIG. 219.—SEARCHER FOR LOCATING THE URETHRAL ORIFICE SIMILAR TO DESORMEAUX'S PROBE.

The hands must be scrubbed clean, and as far as possible the utmost precaution must be taken to avoid touching any part of the instruments but the handles. If this were always done, no infection could occur even with infected hands. Every instrument should be constantly inspected to detect any rough or scaling surface liable to cut the mucous membrane.

Preparation of the Patient.—The patient should come to the examining table with the lower bowel emptied. I find that in many cases it makes a decided difference if she has just eaten a meal, when the bladder does not always expand so well. Immediately before the examination she must empty the bladder in a sitting or standing posture. If the nurse draws the urine with a catheter, or if she passes it on the table, the evacuation will not be nearly so complete.

Anesthesia.—A general anesthetic is only needed for a nervous woman. Local anesthesia by means of a 10 per cent solution of cocain applied on a pledget of cotton wound on a metal rod and introduced just within the external urethral orifice for five minutes beforehand, is sufficient to benumb the sensations so entirely that any required dilatation may be made and the speculum introduced without much discomfort.

Posture of the Patient.—Two postures are available, an elevated dorsal and a knee-chest. The dorsal position is the more convenient to use and the least tiring to the patient, but it is only of service in thin patients, and the atmospheric expansion is not so good; the bladder of a fat woman will rarely distend at all in this posture. The head and thorax rest on the table, while the pelvis is raised by putting one or two bran cushions under the buttocks, so as to elevate them 20 or 30 cm. (8 or 12 inches) or more above the table level. This gives a pitch to the pelvic and lower abdominal viscera which makes them gravitate toward the diaphragm, and as soon as a speculum is introduced the bladder sucks in air enough to distend it.

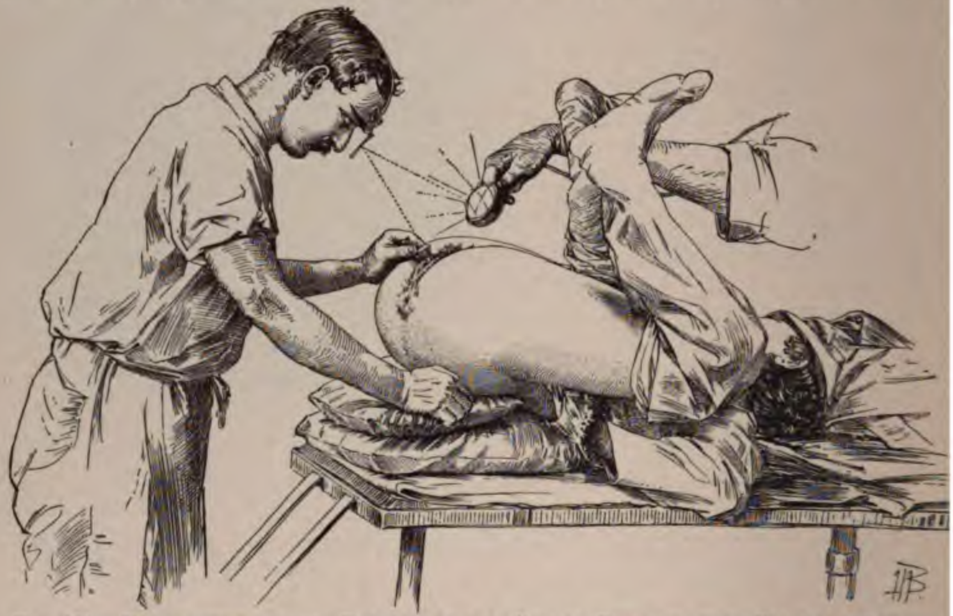


FIG. 220.—EXAMINATION OF THE BLADDER IN THE DORSAL POSITION, WITH ELEVATED PELVIS.

The electric light held close to the symphysis is reflected by the head mirror into the bladder. Th angle of reflection must be as small as possible, so as to avoid constantly displacing the pencil of ligh with slight movements of the head.

When the bladder does not expand, and yet it is particularly desirable use the dorsal position on account of the inability of the patient to stand t inconvenience and fatigue of the knee-chest position, the bladder may be distended and the pelvis relieved of the small intestines by first placing her in the knee-chest position for a minute and letting in air with a catheter; she is then turned on her back with hips elevated on the cushions, taking care to keep the pelvis all the time well above the level of the abdomen. The speculum may now be introduced and a satisfactory examination made. A bladder distended in this way will often remain well distended until the hips are let down again to the table level.

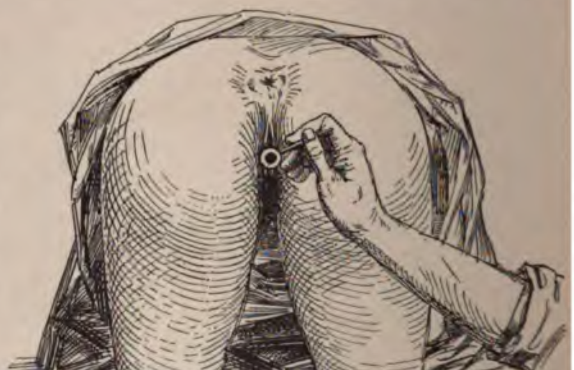


FIG. 221.—VESICAL SPECULUM INTRODUCED WITH THE PATIENT IN THE KNEE-CHEST POSTURE.

The knee-chest position is the one position most satisfactory and applicable in all cases. The patient kneels with her knees separated 10 or 12 inches, close to the end of the table, and, keeping the buttocks as high as possible, lets the back curve in, and brings the side of the face down on the table. If she squats a little, drooping the buttocks slightly toward her feet, she will be more conveniently disposed for the examination. Sometimes, to get a good expansion, it is necessary to push the thighs in the opposite direction beyond the vertical. If she is under an anesthetic, the best way to hold her in the knee-chest position is for two assistants to stand, one on each side, close up to the body to prevent it from falling sidewise, each grasping the body with one arm thrown over the back, and holding the leg in the crotch of the knee with the other hand to keep it from slipping up or down.

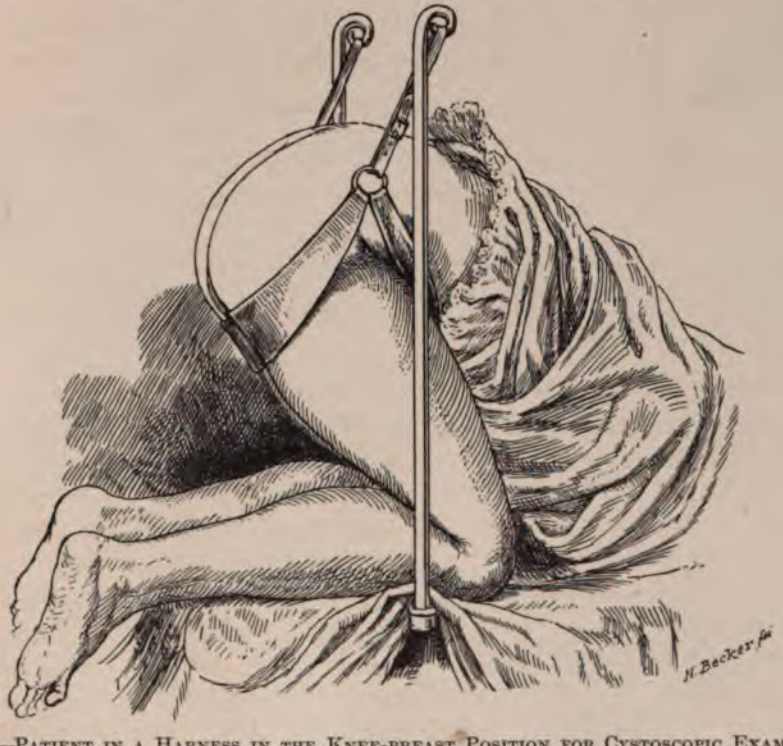


Fig. 222.—Patient in a Harness in the Knee-breast Position for Cystoscopic Examination. The squatting attitude is a little too much exaggerated for the average case.

An apparatus like that shown in the text (Fig. 222) and devised by Dr. G. B. Miller is useful where assistants are scarce, but the thigh bands must not be allowed to cut into the femoral fold.

Calibrating and Dilating the Urethral Orifice.—Before dilating the urethra and introducing a speculum it is well to calibrate it, that is, to measure its diameter in millimeters as a guide to the amount of dilatation needed to admit a speculum; for example, if the urethral orifice has a diameter of 6 or 7 mm. only, it can not be dilated up to 10 or 12 mm. without a slight rupture of its margins; calibration in this case would induce one to use a speculum a size or two smaller than usual. Again, the calibration often shows that the orifice is already so large that it needs no preliminary dilatation. A practiced eye will usually be able to gauge the size of the urethral orifice at once, and to select the exact size of speculum suitable for introduction.

To calibrate the orifice, the small end of the conical dilator, Fig. 217, is pushed into the urethra until it fits snugly, when the index finger marks the point in contact with the urethral orifice; the dilator is then withdrawn and the diameter in millimeters read off. If it is 9 or 10, the speculum of the same number is taken up and introduced without dilatation; if the number indicating the diameter is 7 or 8, the urethra must first be dilated up to the size of speculum to be used.

Boroglycerid forms the best lubricant for dilator and speculum because it is colorless. Vaseline sometimes leaves a film behind which looks like pus.

To dilate the orifice, the dilator, which is one and the same instrument with the calibrator, is introduced into the urethra in the direction of its axis with a slight boring motion, until the required distention is reached in a few seconds. Often there is no injury at all from such a dilatation, while at other times one or two shallow ruptures 1 mm. deep and from 3 to 5 mm. long are made at the posterior margin. I have never seen any serious bleeding nor have had to treat the ruptures later as fissures; only two or three times have I had to put in a fine suture to stop the oozing. An unusually small and rigid orifice should be cut posteriorly, as suggested by Simon; then, after the examination, the cut is closed with one or two fine silk sutures.

Introducing the Speculum.—A skillful examiner will select a suitable speculum (Fig. 216, p. 357), a No. 7, 8, 9, or 10, or one of the half sizes between, according to the case, the age of the patient, and the purpose of the examination; a patient with a sensitive urethra may often be treated with less discomfort and with equal facility through a No. 7½ or 8 speculum. The smaller sizes are better adapted to girls and to young women with small urethræ. Beginners in cystoscopy are apt to select a larger speculum, using always a No. 10 or 11; with experience they will drop a size or two.

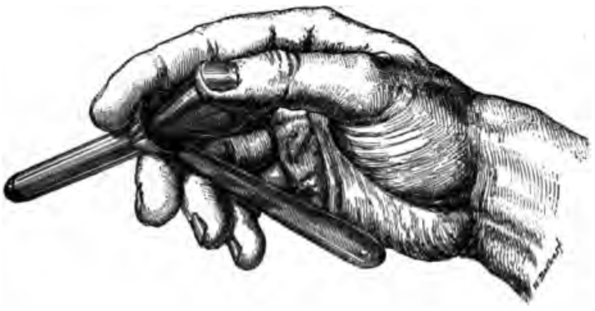


FIG. 223.—HOLDING THE VESICAL SPECULUM READY FOR INTRODUCTION; THE THUMB PRESSES THE OBTURATOR FIRMLY IN.

To introduce the speculum, it is grasped as shown in Fig. 223, and the obturator is kept from slipping back into the cylinder by a decided pressure with the thumb, continued until the end has entered into the bladder. The urethra, wiped clean with a boric acid solution, is exposed by an assistant holding the buttocks and the labia well apart, while the point of the speculum, coated with the boroglycerid solution, is applied to the urethral orifice, and pushed through the urethra into the bladder with a gentle sweep around the pubic arch. The handle of the speculum is now firmly grasped, while the obturator is withdrawn with a slight rotary motion. If the internal urethral orifice is drawn well into the pelvis by the posture, the urethra is so much curved that there is danger of injuring it by pushing the speculum hard against its posterior wall; this must be avoided by introducing the speculum in a decided curve. The moment the obturator is taken out the air rushes in and the bladder is dilated and ready for the inspection.

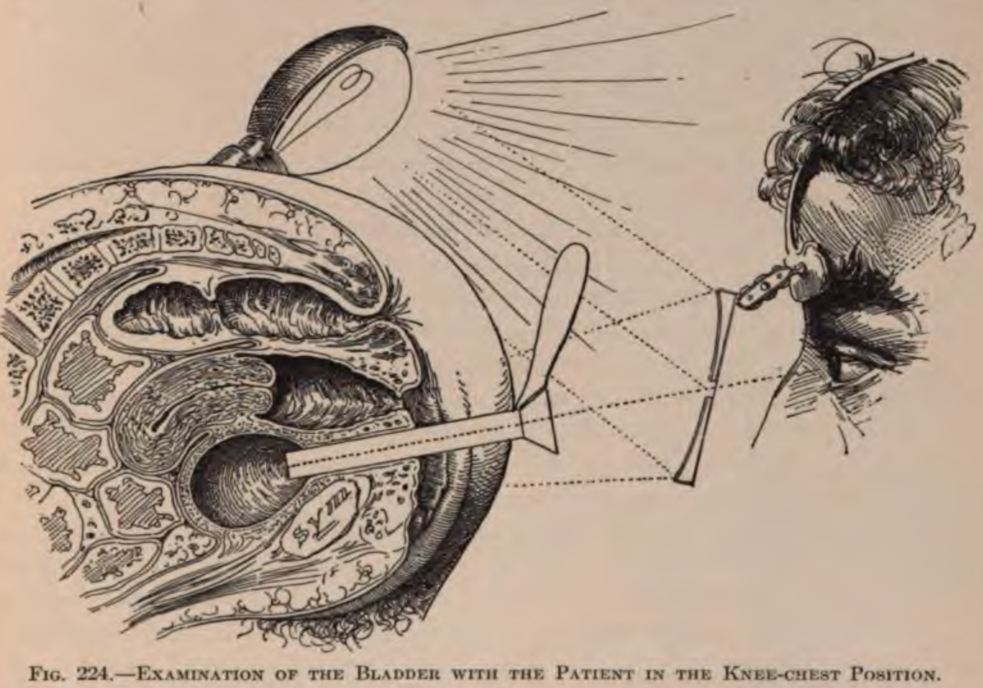


FIG. 224.—EXAMINATION OF THE BLADDER WITH THE PATIENT IN THE KNEE-CHEST POSITION.

If the bladder does not expand in this way the examiner will usually find that the patient has assumed a faulty position, and as soon as this is corrected the expansion occurs.

Viewing the Bladder.—It takes far less time to view the whole interior of the bladder than it does to describe the method of inspection (Fig. 224); indeed, after practice, a few seconds will be sufficient to determine by actual sight whether any portion of the interior is sound or diseased.

If the patient is in the knee-chest position the examiner sits on a stool with his eyes a little below the level of the urethra, grasping the handle of the speculum, which is turned upward, and he should wear the head mirror over the eye which he is accustomed to use at the microscope.

The assistant now holds the electric droplight close to the end of the sacrum, which is protected from the heat by one or two towels, and the lower margin of the head mirror is drawn away from the face and turned until the reflected light spot falls within the bladder. Men accustomed to throat and eye work will find no difficulty in putting a good illumination at once just where they want it, while to the inexperienced man the apparent waywardness of the light will be his chief trouble throughout. The direct ray of the little electric headlight makes the illumination of the field an easier task.

The inspection of the bladder naturally begins with the posterior hemisphere about the posterior pole, opposite the internal urethral orifice, from 3 to 5 cm. distant from the anterior wall, but not more than 2 or 3 cm. from the end of the speculum, which is pushed well into the bladder.

The whole posterior hemisphere is first examined as the end of the instrument is directed to the right and to the left, by alternately raising and dropping the handle so that every part of the mucosa is passed in review at least twice.

The normal background of the inflated bladder seen in this way is a dull white, with here and there large vessels branching and anastomosing over it in an irregular manner. The fine rosy capillary injection seen in a contracted bladder is not visible when it is distended with air, for the minuter vessels are emptied, both by the expansion and by the posture of the patient. At a point 1 or 2 cm. above the posterior pole, a rounded red spot of capillary injection is often seen, which may easily be mistaken for a localized inflammation, but which is merely a suction hyperemia induced at this point by contact with the end of the speculum during the withdrawal of the obturator.

The larger blood vessels spring out of the submucosa, where they are first seen in a hazy way, becoming clearer and with sharply defined outlines on the surface, where they divide and subdivide into numerous branches. Occasionally an artery is seen pulsating, and a large dark vein may sometimes be seen gradually disappearing from view as it penetrates the walls obliquely. The mucous surface on the right and the left of the posterior hemisphere is often divided up by shallow interlacing ridges, or again a sharp ridge 2 to 3 cm. long is seen to cross the field obliquely; these ridges are formed by the inner muscular bundles irregularly arranged. Numerous little glistening points are due to moisture on slight inequalities of surface which catch and reflect the light.

By elevating the handle of the speculum decidedly, its inner end is lowered and the vault or summit of the bladder is brought into view, and every part of the organ inspected by moving the end from side to side. By lowering the handle decidedly, the floor of the bladder is examined in the same way, and then by moving it to the left and to the right, the right and left walls come into view.

The only parts which remain unexamined are those contiguous to the internal urethral orifice, and these are now seen by a still more decided elevation and depression of the handle. With a marked depression of the speculum the vesical triangle comes into view, always a little more injected than the rest of the bladder, due to the fact that the mucosa and the underlying tissues are intimately connected, which prevents this part from expanding and becoming anemic like the rest of the bladder.

Turning the speculum from fifteen to twenty degrees—generally the latter—to the right or to the left a little pinkish prominence is seen—the *mons ureteris* which marks the position of the *ureteral orifice*; this usually looks like a fine transverse line about 2 mm. long on the side of the mons. It is sometimes a faint streak, like a little water line on paper. At other times the orifice appears as a little pit or a mere point. Immediately around the ureteral orifice is a paler area about 1 mm. broad, and surrounding this a rosy area 3 or 4 mm. broad. I have several times seen a blood vessel emerging out of it on to the vesical mucosa. If a **V** with its angle at thirty degrees is marked on the cylinder of the speculum, near the handle, by bringing one of the arms of the **V** parallel to the axis of the urethra the other arm will then point toward one of the ureteral orifices, which may now be found at once on looking through the speculum.

If the ureteral orifice is watched for half a minute or so, a little clear urine will be seen to spout out from the surface, forming a jet which lasts two or three seconds, to be repeated again in the course of a minute.

Sometimes the urine spurts up free from the surface of the bladder, shoots into the lumen of the speculum, and trickles down to the outer edge. By holding the end of the speculum close up under the ureter, or by using the oblique speculum adapted specially to this purpose (Fig. 225), enough urine can be caught up with pledgets of cotton, or in a small graduate, to answer the purposes of a physical, chemical, and microscopic examination. When the bladder is inflamed or ulcerated, it is sometimes of great advantage to get a little urine from one or both sides in this way, because it avoids the risk of a possible infection of a ureter by putting in a catheter.

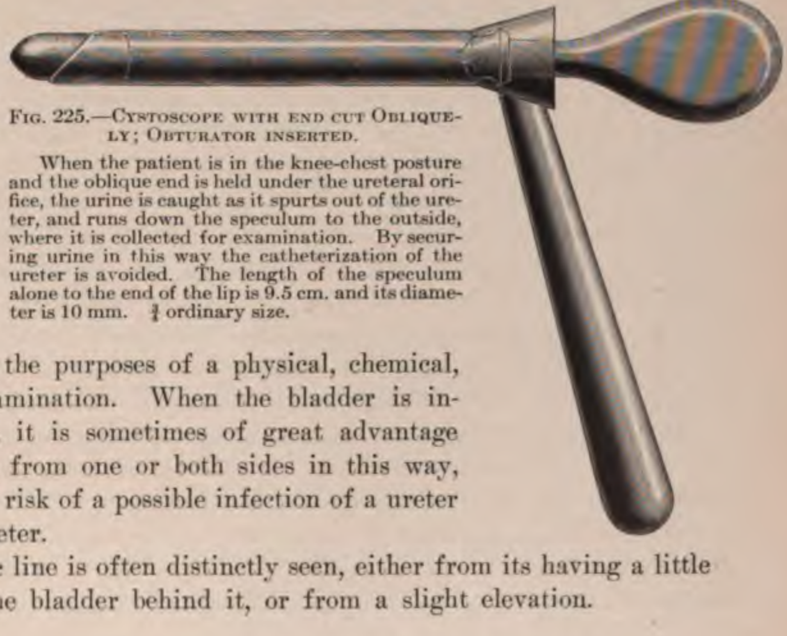


FIG. 225.—CYSTOSCOPE WITH END CUT OBLIQUELY; OBTURATOR INSERTED.

When the patient is in the knee-chest posture and the oblique end is held under the ureteral orifice, the urine is caught as it spurts out of the ureter, and runs down the speculum to the outside, where it is collected for examination. By securing urine in this way the catheterization of the ureter is avoided. The length of the speculum alone to the end of the lip is 9.5 cm. and its diameter is 10 mm. ¾ ordinary size.

The interureteric line is often distinctly seen, either from its having a little deeper color than the bladder behind it, or from a slight elevation.

In the process of the examination of the entire bladder conducted in this way the field of vision has changed from the posterior wall perpendicular to the plane of vision to the triangular area which lies almost parallel to it; at right angles differences in color are best seen, while in the plane of vision outlines which cross it come out more distinctly.

The retrosymphyseal area comes into view on elevating the handle of the speculum so as to direct the inner end toward the symphysis pubis.

Occasionally a bladder will be found which does not remain ballooned out with air, but undergoes periods of more or less rhythmic contraction, each of which lasts half a minute or more. With the contraction there is an influx of blood into the capillaries, and the mucous membrane assumes a rosy hue, becoming more intense as the contraction increases, until the whole organ is thrown into small folds like a labyrinth of cerebral convolutions. With the contraction the air is audibly expelled and often urine comes sputtering out with it. After waiting from half a minute to a minute the contraction relaxes and the bladder expands, so that the examination can be continued. The color and appearance of the walls and of the vessels of a normal bladder must be well fixed in the mind by numerous examinations, because the normal conditions are the standards of comparison in determining the presence of areas of congestion, inflammation, or other diseases.

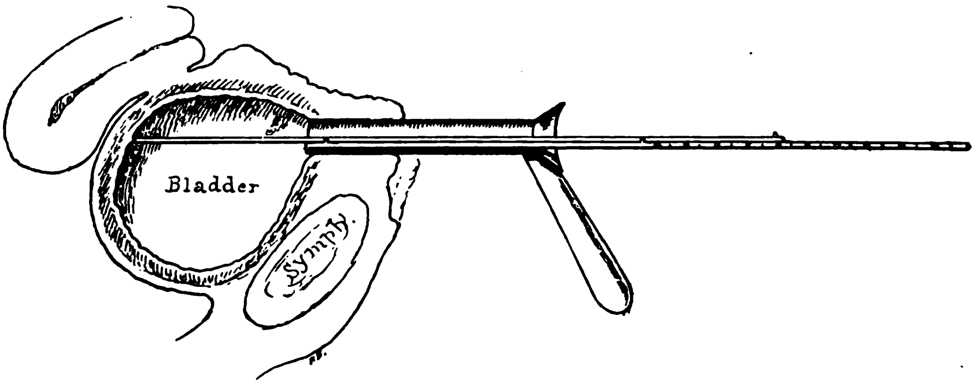


FIG. 226.—INSTRUMENT FOR MEASURING THE DISTANCE BETWEEN THE INTERNAL ORIFICE OF THE URETHRA AND VARIOUS POINTS ON THE VESICAL WALLS.

The distance in millimeters is registered on a graduated arm on the outside. One arm slides along the other and the lower one is provided with a little hook on its inner end to hold it against the inner end of the speculum. Knee-chest posture.

Insufficient expansion of the bladder will be noticed in advanced pregnancy, in the case of a tumor blocking the pelvis, or in ascites. It may also be due to the fact that the patient in taking the knee-chest posture arches her back, and raises her chest too high from the table, thus interfering with the action of gravity on the intestines. Often, too, a little time must be allowed for the viscera to gravitate slowly toward the diaphragm, and so create the suction necessary for the distention of the bladder.

Too great an expansion of the bladder may also be troublesome. The difficulty is that the trigonum and the ureteral orifices are then lifted up so high that the examiner has to bring his head far enough under the patient to render his position extremely awkward and he does not get enough light for the inspection. This may be remedied in several ways:

(*a*) Before introducing the cystoscope a speculum is always put into the vagina, which then balloons out with air and lets its anterior wall with the floor of the bladder drop in the direction of the symphysis; then when the vesical speculum is introduced the available expansion space of the pelvis, already partly occupied by the distended vagina, is so diminished that the floor of the bladder remains more nearly in the plane of vision. In parous women the atmospheric expansion of the vagina is usually spontaneous. Distention of the rectum with air will sometimes produce the same effect.

(*b*) By putting a cotton pack in the vagina or by depressing its anterior wall with a spatula, any particular portion of the base of the bladder can be held down in view.

(*c*) Cases where there is a tendency to an excessive expansion may, as a rule, be easily examined in the dorsal posture, when the expansion is naturally not so great.

The presence of air in the bladder is rarely painful so long as the urethra is open and the air enters and escapes freely with each respiratory movement. But not infrequently as soon as the speculum is taken out the patient feels a cramping pain, which is not relieved until she has been able to seat herself on a vessel to expel the air. To avoid this after-pain, the examiner may leave the speculum in place, or slip a catheter in, and then lower the patient gently from the knee-chest posture on to her side, so as to let the air out gradually.

It is not necessary to take any special precaution after a vesical examination, unless it has been prolonged enough to weary the patient, or unless she is feeble or nervous; under these circumstances rest for an hour or two with a half teaspoonful of aromatic spirits of ammonia may be prescribed.

The field of usefulness of the cystoscopic method just described is a large one, commensurate with the entire field of vesical diseases, and the practitioner who uses it liberally will be rewarded by constantly discovering that affections hitherto described as merely functional have definite local lesions as their basis, and are often speedily amenable to simple methods of treatment.

I wish further to insist that a cystoscopic examination should be made in every case where a vesical affection is more than transient and the diagnosis is not absolutely clear without it, and that every part of the bladder should then be thoroughly inspected.

DISEASES OF THE URETHRA.

Short as the urethral canal is in women, it is liable to a variety of diseases, some of which are peculiar to the sex. These affections are chiefly those which either interfere with function or affect the caliber of the urethra. As the final avenue of egress of the urine, the urethra holds a position analogous to the short anal canal in its relation to the rectal ampulla and the intestines above. Owing to its relation to the external genitals, which are infested with micro-organisms, the urethral orifice is constantly exposed to the risk of infection from without. Its position under the resisting pubic arch renders the urethra liable also to damage from prolonged pressure during labor, or to compression by a tumor which chokes the pelvis. It is protected from external injuries by its concealed position between the thighs and labia.

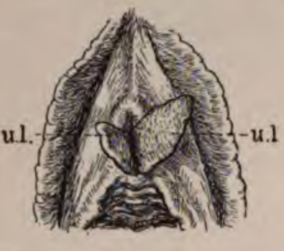


FIG. 227.—THE LEFT URETHRAL LABIUM AS IT APPEARS ON THE SIDE OF THE CALIBRATOR WHICH IS INTRODUCED FOR THE PURPOSE OF DEMONSTRATING ITS PRESENCE.

One of the most important anatomical barriers to infection and to the invasion of the upper ureteral tract by bacteria is the little delicate mucous folds, connivent over the ureteral orifice, best seen when the hymen is intact, and in the nulliparae. These folds are found developed in association with the hymen posteriorly, and as the upper part of the hymen is pulled apart, they become separated, exposing the meatus externus. As the urethral labia lie together, they project beyond the orifice of the urethra in a manner not unlike the labia minora covering the introitus. They are made up of soft, delicate mucous membrane, showing, under normal conditions, no thickening nor hypertrophy (the figures should be corrected in this respect). It is to these folds that the orifice of the urethra owes its cruciform appearance, with the right and left arms of the cross more or less dependent. The urethral labia vary in size, all the way from the delicate structures, scarcely noticeable, to flaps 1 cm. long like elephant's ears, hanging from the posterior lateral urethral margins (see Figs. 227, 228, 229, 230, 231). One of the best ways to see them is by introducing a calibrator as shown in Fig. 232. I first described these structures, which I had long been observing, in the "Twentieth Century Practice of Medicine," Wm. Wood & Co., 1895, vol. i, p. 665 (see also *Amer. Med.*, 1903, vol. vi, pp. 429 and 465). Dr. R. L. Dickinson, of Brooklyn, who has given more attention to these structures than any other

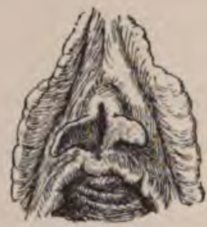


FIG. 228.—LONG URETHRAL LABIA OF UNEQUAL LENGTH.

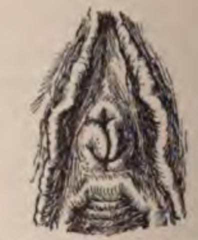


FIG. 229.—ATTENUATED URETHRAL LABIA.

living surgeon, has particularly noted their relations to hypertrophic conditions associated with masturbation (see illustrations in *Amer. Med.*, Feb. 27, 1904, p. 347).

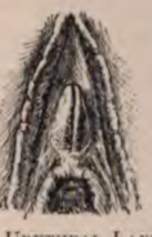


FIG. 230.—URETHRAL LABIA CONNIVING TO PROTECT THE ORIFICE. THE LABIA IN THIS CASE ARE SHOWN THICKENED. THEY SHOULD BE MORE DELICATE AND ATTENUATED.

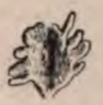


FIG. 231.—CONNIVANT LABIA COMPLETELY CONCEALING THE URETHRAL ORIFICE.

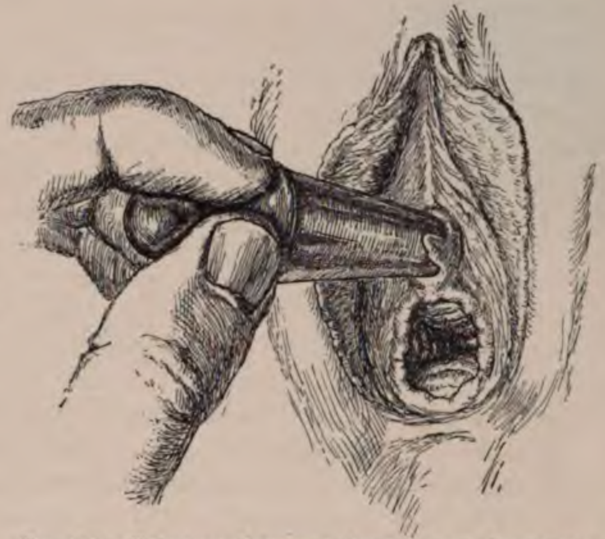


FIG. 232.—EXTERNAL URETHRAL ORIFICE WITH FIMBRIATED LABIA.

Affections of the urethra may conveniently be considered under the following heads: Malformations, displacements, dilatation, stricture, ischuria, fistula, foreign bodies, hyperemia, urethritis, new growths.

CONGENITAL MALFORMATIONS.

Congenital malformations of the urethra are among the rarest gynecological affections. The commonest is a distinct lateral displacement of the external orifice, generally about 2 mm., to one or the other side. A shallow vertical fissure corresponding to the urethral orifice may be found on the opposite side with a sharp ridge between the two; this gives the appearance of a double urethral orifice.

Most malformations of practical importance are due to a deficiency of the development of some part of the urethral canal.

These may be classified as: (*a*) hypospadias, (*b*) epispadias, (*c*) imperforate urethra, (*d*) totally deficient urethra.

Hypospadias.—In hypospadias, part of the inferior wall of the urethra is wanting and the external urethral orifice opens at some point in the anterior vaginal wall. One of the best described cases is that of A. Lebedeff (*Arch. f. Gyn.*, vol. xvi, p. 290). The patient was a married woman, twenty-three years old, a nullipara. She had always been well in every respect until five years married, when she began to experience a pressure on the bladder and to suffer from an involuntary escape of urine, at first at night after coitus, but soon becoming constant. An examination showed normal labia, nymphæ, and clitoris. But in the vestibule, instead of a urethral canal, there was a furrow, lined with a delicate mucous membrane, and leading back over the anterior vaginal wall, between vaginal folds so closely applied as to form a distinct ridge; this furrow ended in a canal 2 cm. long and situated 2 cm. within the introitus, which admitted two fingers directly into the bladder. The upper wall of this furrow, seen on drawing aside the protecting vaginal folds, was covered throughout with a bright-pink mucous membrane crossed by a fine network of vessels. The fact that the patient had never borne a child, and the straight course of the canal, associated with the entire absence of any cicatricial tissue, showed that the condition was a congenital defect of the inferior wall of the urethra extending as far up as the neck of the bladder. The incontinence had been brought on mechanically by coitus.

A case of my own, more properly classified, as F. Winckel has pointed out, as a persistent urogenital sinus, was a nullipara forty-six years old; the external genitals were normal as far as the introitus of the vagina, where the only opening between clitoris and rectum was found. There was no hymen, and the smooth orifice beneath the pubic arch had the form of a transverse slit. If the finger was pushed in, it invariably entered a short muscular canal, which was the shortened urethra, and so passed directly into the bladder. The urethral orifice was in this way situated about 1 cm. behind the pubic arch, and the urethral canal was only 1 cm. long. While the inferior wall of the urethra was absent, the anterior wall continued on out as far as the vestibule, but was not of normal length. The upper wall of the introitus was vascular and of a deep-red color, and presented numerous longitudinal mucous folds. There was a gaping slit in the anterior vaginal wall 1 cm. long, which shortened the caliber of the urethra by so much. If now the point of the sound introduced into the vagina was turned sharply down over the perineum, it would then enter one or the other of two orifices lying side by side, and separated by a fleshy septum; this was a double vagina about 8 cm. (3 inches) deep, with a small cervix in the vault of each half. The incontinence and distress the patient had complained of in coitus was relieved, and the channels returned to their normal usage by a plastic operation, freshening and uniting the edges of the flaps, and converting the two vaginæ into one by removing the septum.

Similar to this was the case of a short dilated urethra reported by Dr. W. H. Baker, of Boston (*New York Jour. of Gyn. and Obstet.*, Oct., 1893); here there was no trace of an upper urethral wall, and there was therefore a complete absence of the external part of the urethra, *defectus urethræ externæ*.

Epispadias.—In epispadias there is a defect of the upper wall of the urethra associated with a separation of the labia minora and division of the clitoris. In its extreme form the symphysis gapes, the anterior wall of the bladder is deficient, and the bladder becomes everted (exstrophy).

Atresia.—Congenital atresia of the urethra may be due either to defective intra-uterine development, when it is associated with other anomalies, or it may be acquired late in intra-uterine life by an agglutination of a portion of the urethral canal. The latter condition was clearly the one obtaining in the case of a child two days old (Mandl, *Wien. klin. Wochenschr.*, 1891, p. 515), which vomited and had general convulsions until the atresia was broken down by a sound, when turbid concentrated urine escaped and the disturbances ceased. There was no marked distention of the bladder or evidence of hydronephrosis.

When the atresia is due to defective development a number of other coexisting defects are usually found, as in the instance reported by F. Schatz (*Archiv f. Gyn.*, Bd. i, p. 12), where there was a double uterus, double vagina, and double bladder. As there was no urethra, each of these bladders opened by an orifice in its base into the corresponding vagina.

If the atresia is a complete one, in order that the child so affected shall live, nature must have provided some other channel for the escape of the urine, such as an opening into the bladder through the symphysis, or a patulous urachus, which discharges at the navel. If there is no avenue of escape for the urine, this will, even during intra-uterine life, accumulate in such quantity as to produce an enormous distention of the bladder, ureters, and kidneys, with ascites. Under these circumstances the distended abdomen forms a serious hindrance to the birth.

Congenital Absence of Urethra.—In these cases all trace of the urethra is wanting, both external and internal orifices, and upper and lower walls, and the base of the bladder opens directly into the vagina, with which it forms one common canal.

DISPLACEMENTS.

The urethra is liable to displacements of two kinds: (1) Those affecting the entire urethra with the adjacent tissues; (2) those affecting the mucous membrane of the urethra alone.

Displacement of the Entire Urethra.—The anatomical and topographical relations of the urethra are such that it is most favorably situated to prevent displacement. Its shortness, its position directly under the pubic arch, and the dense fibrous connection with the adjacent parts all resist any ordinary efforts to force it out of its natural position. The commonest change in position is noticed when the vaginal outlet is relaxed and gaping, and the base of the bladder descends with the anterior vaginal wall to fill up the gap. Careful inspection and the use of a sound then show that the urethra has rotated outward and forward around the symphysis as its axis; the external orifice lies farther forward and its direction more upward than normal, while the internal orifice has sunk with the bladder. In prolapse of the elongated cervix uteri with a vesical diverticulum in the pouch the urethra often undergoes a still more marked change in its direction, gradually yielding to the traction of the prolapsed sac, first at its internal orifice, and then the lower portions, until the whole urethra finally lies outside the body. The canal sometimes assumes a sigmoid curve, which makes it difficult to pass a catheter.

The symptoms of this condition are those referred to the prolapsus and those which arise from difficulty in emptying the bladder. Unless the patient is in the habit of pushing up the sac for this purpose, the evacuation is often incomplete and decomposition of retained urine may set in with all its untoward sequelæ.

Upward displacement of the urethra occurs during labor and when the urethra is drawn up by a full bladder. It also occurs in the case of large subperitoneal tumors of the uterus, which drag the bladder high up, and with it the urethra, sometimes changing its horizontal direction to a vertical one. The difficulty of emptying the bladder may be great, but it is sometimes also surprisingly easy. In relieving the patient, it is safer to use a soft catheter, which finds its own way into the bladder. If a metal or glass catheter is used it must be done with the gentlest touch, feeling for the channel with each advance of the instrument. I know of a doctor who decided to perform a Cæsarean section on a woman in whom the head of the child was sticking in the pelvis. As a preparatory measure he attempted to empty the bladder, but instead of doing that he forced the catheter through the urethra into the child's head several times, and when the catheter was removed its eye was found full of brain tissue. The operation was abandoned on this account, and in several days a dead child was born spontaneously, with perforations in its head which were the cause of much curious speculation on the part of the friends.

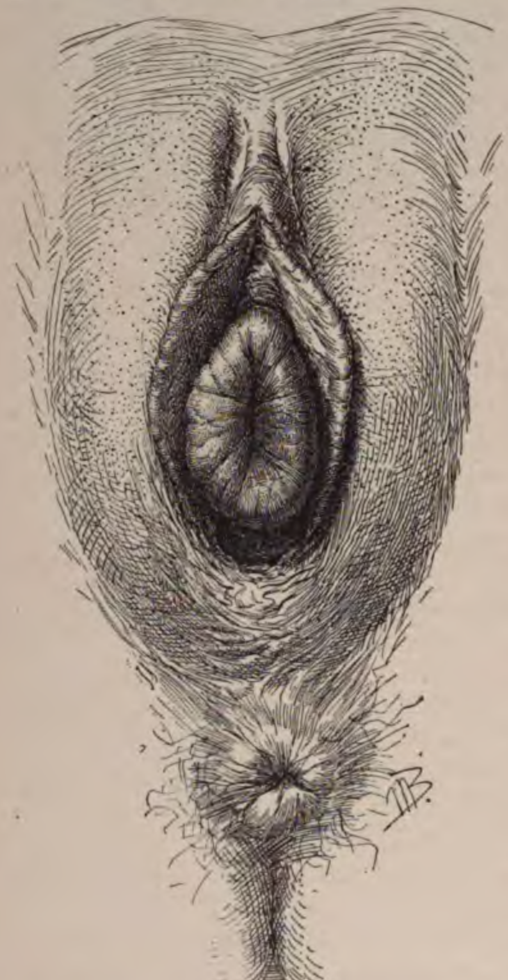


FIG. 233.—HYPERTROPHY OF THE URETHRAL MUCOSA AT THE EXTERNAL ORIFICE. APRIL 16, 1896.

Prolapse of the Urethral Mucosa.—A more or less complete eversion of the mucous membrane of the urethra is found in rare instances. While the rest of the urethra remains in its normal position the mucosa becomes loosened from its submucous attachments and is gradually extruded at the external orifice, forming a pale, deep-red, or bluish tumor, which swells and becomes edematous and even gangrenous if left to itself. As the anterior, posterior, and lateral walls of the urethra are all involved, the protruding mass is tubular, and is lined within as well as covered without by a sensitive, easily bleeding mucous membrane. No age is exempt from prolapse of the urethral mucosa, but the affection is far commoner in young children; in two cases reported the patients had reached the advanced age of seventy and seventy-two years.

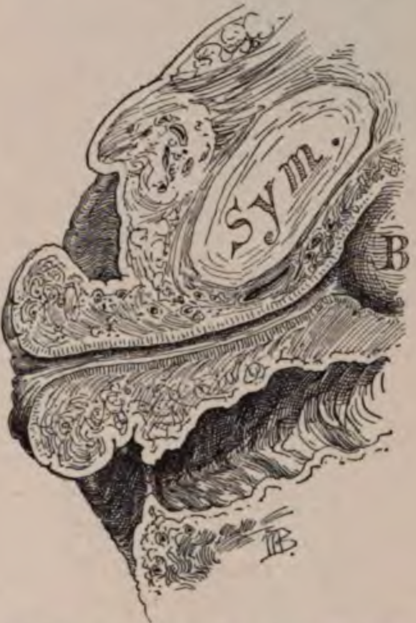


FIG. 234.—HYPERTROPHIED EXTERNAL ORIFICE OF THE URETHRA SHOWN IN SAGITTAL SECTION.

Sym. is the symphysis; B, the bladder; the vagina lies below.

The prime cause of the affection is usually struma, but the immediately exciting cause may be a blow, straining, or coughing, or rape. Inflammation of the mucosa also occasionally produces a prolapse, which is as a rule only partial.

The diagnosis will be made upon separating the labia, when a vascular tumor with a slit in the center of it opening into the bladder will be seen at the site of the urethra and choking its orifice. This condition must be distinguished from caruncle of the orifice or a hemorrhoidal pouting of the mucosa at the orifice, as well as from eversion of the mucosa of the bladder or of the ureter.

The seat of a caruncle is usually on one side of the external urethral orifice. An eversion of the mucosa of the orifice forms but a shallow protrusion not more than 5 or 6 mm. long.

In everted bladder the base of the tumor is found by a sound to be within and attached to the bladder, instead of at the external orifice of the urethra. The bladder tumor also lacks a canal. An everted ureter is attached to the bladder wall and a fine sound or catheter 1½ mm. in diameter passes through the tumor on up over the pelvic brim into the kidney.

The treatment will vary with the conditions. The cautery so often used, ought to be given up entirely for cleaner surgical methods. It is also unadvisable to transfix and ligate the protruding mass and allow it to slough away, or to cut it away beyond the ligatures, as has been done.

The first and simplest plan to be tried in a recent case is reposition, after getting rid of the sensitiveness, either by means of a weak solution of cocain or by anesthesia. By compressing the tumor on all sides and at the same time pushing it back into the urethra a replacement may be effected which will prove permanent; the patient should be kept in bed afterwards, a vulvar compress applied, and small doses of belladonna should be given as a sedative by rectal suppository.

If the tumor can not be replaced, or if it escapes again directly after replacement, an operation will be necessary, and the best is the excision of the protruding portion with knife or scissors, followed by a carefully applied continuous suture of fine catgut, uniting the cut edges and checking the hemorrhage. It is important to catch both edges as they are cut, to prevent an inversion with excessive hemorrhage.

DILATATION.

Variations in the caliber of the urethra, both dilatation and stricture, are of infrequent occurrence. Dilatation, however, a disease never found in men, is far commoner than stricture, a disease so often found in them.

Dilatation of the urethra is an enlargement of its lumen, the result of any injury to the circular fibers by a trauma from without, or by some object forced through its canal in either direction. All grades of dilatation are found from a slight one which permits an escape of the urine only noticed on coughing, sneezing, or lifting, to the extreme forms where the bladder is incapable of holding even a few drops of urine. The worst forms entail all the miseries of a large vesico-vaginal fistula.

The commonest cause of an extreme dilatation is coitus *per urethram* in women with either a congenital or an acquired atresia of the vagina. In these cases the external urethral orifice is gaping and everted, and the examining finger is often carried into the bladder without any apparent resistance (see Fig. 209, p. 338). I have seen three cases, in one of which two fingers could be easily introduced into the bladder, where a distinct contraction was felt at the position of a much thickened, internal vesical sphincter. The consequences of a dilatation of this character are often less serious than would be anticipated, for, in spite of the extreme distention of the urethra, the patient may be able to retain her urine for several hours, or at most notices a decided incontinence following coitus only.

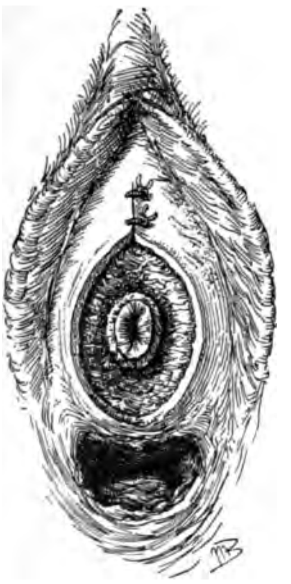


FIG. 235.—OPERATION FOR HYPERTROPHIED URETHRAL MUCOSA.

A circular amputation with approximation of the tissues of the vestibule and the anterior vaginal wall to the urethral mucosa. The vagina is seen below.

It is quite otherwise with the cases of dilatation of the urethra where a large finger has been bored in for diagnostic purposes. The extensive rupture of the muscular fibers is then followed by an incontinence which is often permanent. These cases are fortunately becoming rare, as this barbarous way of examining the bladder is being given up. With our present facilities for examination, we are never warranted in introducing a finger through a urethra which is not already dilated, so as to admit it without resistance.

Another cause of dilatation is that which acts from within outward, as when a large stone under the spasmodic contractions of the bladder is pushed down into and on out through the urethra, or when a stone is grasped and dragged out by a stone forceps. It is remarkable, however, what the urethra will stand in this way, for a stone even an inch or more in diameter passed spontaneously in this way may not be followed by more than a transient incontinence.

The partial incontinence following repeated births is undoubtedly due to injury to the circular fibers of the urethra by the compression produced by the child's head, and is apt to increase after each fresh insult. A common form of incontinence is that seen in women who have borne children and yet have never had any difficulty until they approached the menopause. They then note for the first time occasional spurts of urine wetting the clothing on making any unusual exertion such as sneezing, laughing, or taking a high step, etc. The trouble as a rule grows worse and is persistent.

Treatment.—If the dilatation has been but recently and suddenly produced, as by the passage of a stone or by forcing a finger or two large dilators through the urethra, and there is no evident laceration, it will be well to wait a few days, simply keeping the parts clean and free from contamination by vaginal douches and local application of a boric acid solution; and if there is any definite improvement it will be well to wait as long as it continues. If there is any evident laceration at the external meatus, this should be sutured under cocain, first trimming off all unevenness and then uniting the parts from side to side with fine interrupted silk sutures, using a small fine needle. When the relaxation is due to coitus and the abnormal channel has been created in place of an atresic vagina, nothing can be done until the vagina is restored to its integrity.

The condition of a patient with an incontinent urethra is so pitiable that as eminent an authority as Rutenberg (*Wien. med. Wochenschr.*, 1875, No. 37) even proposed to cure it by closing the urethra entirely and making a suprapubic fistula, which was to be controlled by the pressure of a pledget.

In general four plans have been tried with varying success in attempting to overcome incontinence. These are:

(*a*) A vaginal pessary.

(*b*) A longitudinal resection of the vaginal wall, with or without a piece of the urethra.

(*c*) An operation to flatten out and compress the external urethral orifice.

(*d*) Twisting the urethra spirally so as to narrow its caliber.

It is not possible in the absence of a larger experience to speak with decision as to the comparative merits of the three operative procedures proposed, but I would prefer as a first resort to resect after the plan proposed in (*b*).

If the incontinent urethra was near the normal caliber I should use Pawlik's plan (*c*).

If the incontinence is due to the traction or scar tissue in the anterior vaginal wall on the neck of the bladder, this must first be freely incised to do away with the traction. Permanent relief has even been obtained in this way.

(*a*) F. Schatz (*Arch. f. Gynäkol.*, vol. xi) has been able to give relief by means of his funnel-shaped pessary, which presses directly upon the urethra. Similar results have occasionally been secured by the use of a ball pessary large enough to press the urethra against the symphysis and hold the urine back until the intravesical pressure has increased to a degree sufficient to overcome the obstacle. An intact levator ani is necessary for the successful use of a pessary, which can not give relief in a relaxed vaginal outlet.

(*b*) An excision of the superfluous relaxed portions recommends itself as the most rational plan, and it has yielded excellent results in the hands of Frank and Engström.

Frank's procedure (*Centralbl. f. Gynäkol.*, 1882, No. 9) is to lay a small catheter in the urethra and then to excise a wedge-shaped piece from the posterior urethral wall, including the vaginal as well as the urethral mucosa, and extending from the external urethral orifice to within about 1 cm. of the internal orifice. The incision is now continued in an elliptical form on the vaginal wall beyond the neck of the bladder. By a transverse row of interrupted sutures the whole wound surface is now accurately approximated. The lower anterior part of the incision underlying two-thirds of the urethra simply resects its relaxed canal, while the width of the elliptical portion of the denudation has been calculated so as to form a sort of buttress behind the neck of the bladder like the third lobe of a prostate in the male.

Engström (*Berl. klin. Wochenschr.*, 1887, p. 744), in an anemic, badly nourished woman, fearing a failure of union on the side of the urethral mucosa, carried his excision on the vaginal septum down to the urethral mucosa, but did not include it. The wound suppurated and healed by granulation with the formation of scar tissue, and as a result the patient was able to hold her urine four hours by day, and all night.

(*c*) By flattening the outer end of the urethra and bending it at the same time, Pawlik (*Wien. med. Wochenschr.*, 1883, Nos. 25 and 26) relieved several patients of incontinence. His plan is to draw the orifice of the urethra well forward toward the clitoris and sharply to one side; then, marking the point on the side to which it could be drawn without excessive traction, a long, narrow denudation about 2 cm. long ($\frac{3}{4}$ inch) is made in the sulcus, and sutures passed to hold the urethra in that position. After a week, when the sutures are removed, the other side of the urethra is drawn upward and outward in the same manner, and the sulcus on that side denuded and sutured. By this means the urethra receives a sharp bend forward and the posterior wall is strongly flattened against the anterior by traction on both sides.

(*d*) Torsion of the urethra is a plan proposed by R. Gersuny (*Centralb. f. Chir.*, 1889, p. 433). The whole urethral canal is dissected out from the surrounding structures as far as the neck of the bladder, and the urethra is then twisted on itself, so as to form a series of spiral folds, when it is sutured so as to be held in this position. Gersuny relieved his patient after twisting the urethra one and a quarter times on itself—that is, through an arc of 450 degrees.

Desnos (*Ann. des mal. des org. gen.-urin.*, 1890, p. 344) partially relieved a patient by ligating the urethra. He first introduced a catheter into the bladder, and then cut through the vaginal mucosa so as to expose the upper two-thirds of the urethra; this portion was then isolated by a catgut ligature placed 2 or 3 mm. from the neck of the bladder and tied so tight that the catheter could just be moved. The vaginal incision was then closed with silkworm gut. A small wedge was also taken out of the gaping external orifice. The result was an immediate power of retention for three hours, afterwards reduced to one hour and a half.

STRICTURE.

A stricture of the urethral canal so large as to interfere with the free exit of the urine from the bladder is rare. Strictures of large caliber in which there is no evident impediment to urination or to the passage of an ordinary catheter have been described and their importance insisted upon by Dr. Ely Van de Warker (*Medical News*, Philadelphia, 1887, p. 59). They are to be recognized by using olive pointed bougies, which catch and trip in the stricture as they are withdrawn. Dr. Van de Warker finds that the evil results of a neglected stricture of large caliber in women are similar to those in men; but confirmation of these important conclusions are still wanted from other clinicians.

A variety of causes may operate to produce a stricture, some of which are:

1. A localized thickening, produced by a chronic gonorrheal urethritis.
2. A cicatricial contraction of the anterior wall of the vagina, following a slough produced by labor.
3. The cicatrization of a chancre, whether in the vagina or in the urethra.
4. Carcinoma of the urethra.
5. Extreme contraction of the external meatus without assignable cause.

Gonorrheal stricture is the commonest of all forms, although it has as yet received but little attention in women. Its history is often difficult to obtain, owing to the slightness of the symptoms produced by a chronic gonorrheal urethritis. The slough which follows labor is more apt to result in a urethro-vaginal fistula than in a stricture.

The **symptoms** of stricture are difficulty and pain in micturition, the urine being expelled in drops, or in a fine stream with considerable straining. These difficulties increase as the caliber of the stricture lessens, although occasionally even an extreme contraction of the urethra may elicit no complaint. I remember well my first case, a German woman of about fifty-two, from whom I removed 252 gallstones. After the operation she could not urinate lying on her back, nor could the nurse catheterize her. I found just within the external orifice a cicatricial narrowing of the urethra, which only allowed a fine catheter 2 mm. in diameter to pass with difficulty. The patient was not conscious of there being anything wrong, nor was I able to get any history or to determine the cause of the stricture.

The **diagnosis** will be made readily if every case complaining of any urinary disturbances is examined locally. The effort to catheterize or to pass a vesical speculum will at once tell whether an obstruction exists or not, and if so, the urethra may be calibrated with bougies and the stricture studied urethroscopically, determining its exact size, position, extent, appearance, and consistence.

The **treatment** will depend upon the form of the stricture and its cause. In secondary cancerous disease which can not be eradicated, in the earlier stages the bladder should simply be catheterized regularly; later, when the obstruction increases, a vesico-vaginal fistula may be made, or, if necessary, the ureters may be set free and turned into the vaginal vault. In one of my cases of syphilitic thickening the urethra was reduced to a rigid canal, with extensive ulcerations at the external orifice; the patient had beside this a universal cystitis and hypertrophy of the bladder walls.

In cicatricial contraction of the anterior vaginal wall compressing the urethra, if the cicatrix is narrow, the plan of making multiple incisions into it under cocain, may be tried. If this does not succeed, the cicatrix should be dissected out, even going so far, if necessary, as to resect the lower walls of the urethra with it; then, after an exact closure of the wound with fine interrupted sutures passed close together, a catheter should be left in the bladder for four or five days to relieve the canal of any strain.

When the stricture is narrow and more or less circular, as in the gonorrheal stricture, the lumen should be enlarged by incising or dilating it.

A stricture which allows a bougie 2 or 2½ mm. in diameter to pass may be dilated by passing the bougies daily, until a No. 4 or 5 is passed. After three or four days a No. 5, 5½, and 6 may be passed, and so on gradually up to No. 10, the maximum. A smaller stricture, admitting only a No. 1 or 1½ bougie, may be exposed through the urethroscope, its edges incised slightly, and then dilated up to No. 3 or 4, gradually followed by the larger dilators until the lumen is restored to the normal size.

Care must be exercised to keep the field free from contamination, and not to transport the germs on the external urethral orifice into the canal every time the dilators are used. If the stricture is limited in its extent, and an examination shows that there will be but little risk of an extensive rupture, a rapid dilatation may be practiced, as recommended by E. Hermann (*Trans. of the Obst. Soc. of London*, for 1887, xxix, p. 27), restoring the urethra to a normal caliber at the first sitting.

All cases treated by dilating must be kept under observation for a long time, as a good percentage show a decided tendency to relapse, when the dilatation must be repeated. I gave one of my patients, who was an intelligent nurse, a glass catheter, with the instruction to use it at intervals to discover whether the stricture was recurring and to keep it open, and she did this with good effect.

A stricture confined to the external meatus is easy to treat by benumbing the part with a strong solution of cocain and using the conical urethral dilator, or, if it is very tight and the scar tissue extends deep, an incision 5 mm. deep may be made through the posterior margin and the urethral and vaginal mucosæ sewed together.

ISCHURIA.

Ischuria is an affection in which the patient, often without a demonstrable mechanical cause, is unable to void the urine which is then retained in the bladder. It is sometimes seen in hysterical girls, and often in the puerperal state, where it is probably due to pressure on the neck of the bladder by the head of the child during its descent, benumbing the nerves and so destroying for a time the reflex sensibility. That this is probably the correct explanation is borne out by the fact that it oftenest follows forceps labors.

The diagnosis is usually easy to make by the discovery of a distinct tumor just above the symphysis pubis; on introducing the catheter the urine escapes and the tumor at once disappears. I had one case in a young woman with anorexia nervosa, in whom I palpated and percussed the flat lower abdomen and concluded that there was no urine in the bladder, but on putting in a catheter 500 c.c. of urine escaped; the bladder had distended laterally.

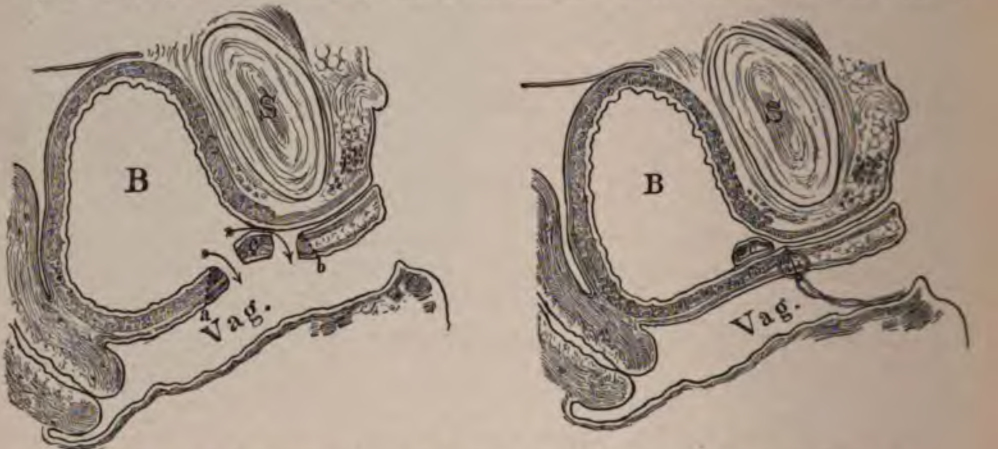
The best way to treat puerperal cases is first to try letting the patient urinate by sitting erect on the vessel, and if this does not succeed to practice a rapid dilatation of the urethra under cocain. The external genitals are carefully cleansed and the caliber of the urethral orifice taken. Cocain (10 per cent solution) is then applied for five minutes in the canal and the first dilator used, followed immediately by a size a half millimeter larger, and this by the next size, and so on up to No. 12 or 14 mm. in diameter. Often the patient will be permanently relieved at once, or at most the passage of the same numbers once more after an interval of a day or two will relieve the ischuria.

In an anemic, hysterical patient the condition of the blood, and the nervous symptoms, the bowels, and the digestion should receive especial attention. Strychnin is one of the best systemic remedies given in full doses.

URETHRAL FISTULA.

A urethro-vaginal fistula following labor is a rare occurrence. When the urethra is involved the lesion is located in the upper part, oftenest at the neck of the bladder, and is frequently found in association with an extensive injury to the base of the bladder, forming a vesico-urethro-vaginal fistula. Not so rare, however, is a fistula artificially created to draw out a redundant urethral mucosa and relieve dysuria (Emmet's buttonhole operation).

Urethral fistulæ usually involve the lower wall only, and appear either as elliptical openings from 1 to 1.5 cm. long or as a fine circular opening not larger than a pin head. If the fistula is close to the neck of the bladder there may be a frequent involuntary escape of urine. If it is farther down in the canal there may be no symptoms at all pointing to its existence, and under these circumstances there is no reason why the fistula accidentally discovered should be operated upon.



FIGS. 236, 237.—URETHRO-VAGINAL AND VESICO-VAGINAL FISTULA IN THE SAME PATIENT.

A small bridge of tissue (*c*), including the neck of the bladder, remained intact. The upper border of the vesico-vaginal fistula (*a*) and the lower border of the urethro-vaginal fistula (*b*) were denuded and united without sacrificing the neck of the bladder (*c*). See also Fig. 238.

I have seen but two cases, both resulting from the traumatisms of labor. In one there was an elliptical opening in the floor of the urethra at about the middle, 1.5 cm. long by 3 mm. wide, and in the other a round opening about 4 mm. in diameter, just in front of the neck of the bladder, while just behind the neck there was a vesico-vaginal fistula a little larger in diameter.

The **treatment** of a simple fistula which does not involve more than one-third of the lumen of the urethra is like that of vesico-vaginal fistula, by a funnel-shaped denudation of its margins, broad on the vaginal surface, and reaching up to, but not including the urethral mucosa. Fine silkworm gut sutures are then passed transversely, and tied so as to bring the edges into exact apposition. It is better to leave a catheter in the bladder for five days. The stitches should be removed in from seven to ten days.

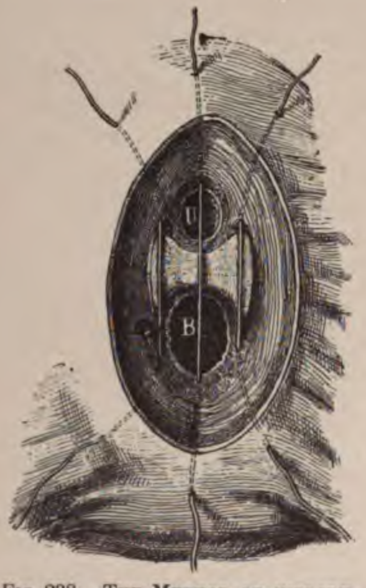


FIG. 238.—THE METHOD OF INTRODUCING THE SUTURES IN THE CASE OF VESICO-VAGINAL FISTULA (B), AND URETHRO-VAGINAL FISTULA (U).

The bridge of tissue between U and B is the neck of the bladder.

In a case in which a urethral fistula just below the sphincter was complicated by a vesical fistula just above it, leaving intact the vesical sphincter ring at the internal urethral orifice, the problem was to save this important bridge of tissue with the hope of retaining its sphincter action. The bridge was so narrow that both sides of it could not be denuded and sutures passed, so the plan was adopted of denuding the margins of both vesical and urethral fistulæ, treating them as if they constituted one large fistula instead of two small ones; the urethral sphincter lying between them was not touched. The denudation was made down to the vesical and urethral mucosæ, and extended out broadly on to the vaginal mucosa; interrupted sutures of silkworm gut were passed in an antero-posterior direction, so as to make the line of union a transverse one. The union was complete and the patient had entire control of her urine, in spite of the fact that a short circuit was made in this way from the bladder under the sphincter portion into the urethra.

FOREIGN BODIES IN THE URETHRA.

Foreign bodies are but seldom found in the urethra. They arise either from a calculus escaping from the bladder and caught in the urethra, or are introduced from without through the external urethral orifice, or they are formed within the urethra itself.

In cases where the foreign body forms in the urethra or is lodged there from the bladder, it is quite sure to be a phosphatic calculus.

When the foreign body is introduced from without, if it remains long enough, it becomes incrusted with phosphates, and so forms a calculus. I have the specimen of a peculiar form of urethral calculus in a case in which the bladder was choked with a large ovoid stone, from one end of which a mass about 3 cm. long and 2 cm. in diameter projected into the urethra. The outer end is pointed, while a constriction at the upper end indicates the position of the neck of the bladder. These calculi closely resemble the calculi filling the pelvis of the kidney, and projecting into the ureter.

The **symptoms** of a urethral calculus are frequent and difficult micturition, with alkaline urine containing mucus, pus, or blood.

The examination by the vagina reveals an enlargement in the anterior vaginal wall, somewhat movable and tender on pressure and densely hard, feeling through the thick mucous covering like cartilage. On attempting to introduce a catheter into the bladder, the point strikes against the hard substance and the diagnosis is clear.

Treatment.—The best mode of treatment, when the stone is not too large, is to extract it by the meatus in the manner proposed and practiced by Prof. A. J. C. Skene ("Diseases of the Bladder and Urethra in Women," New York, 1878, p. 345). In one of Dr. Skene's cases the stone was lodged near the meatus; the forefinger of the left hand was introduced into the vagina and pressed above the calculus to steady it. A wire curette was passed through the meatus beyond the stone, when by traction with the curette and pressure with the finger the stone was extracted. This is not unlike the classical method of treating vesical calculi in women. In another case of a stone higher up in the urethra Prof. Skene was able to fix it firmly by pressure through the vagina so as to grasp and extract it by forceps.

In a case of Prof. F. Schatz (*Verhand. d. deutsch. Gesell. f. Gynäkol.,* II Cong., Leipzig, 1888, p. 115) a urethral stone weighing 100 grains formed around a hairpin which had escaped into the urethra in masturbation three quarters of a year before. The stone was 8 cm. (3 inches) long, and projected well back into the bladder. The patient passed this stone spontaneously with severe straining and bleeding for two hours; she afterward suffered from incontinence. Similar to this was the case of A. Mazario (*Siebold's Jour. f. Geb. und Frauenzim. und Kinderkrankh.,* No. 7, p. 794). The patient had thrust a long sewing needle into the meatus, which penetrated the urethro-vaginal septum and was lost. A calculus formed in the wall between the vagina and urethra, which was removed by cutting down through the meatus half an inch on both sides of the tumor and pressing it out by a finger in the vagina. After removing the stone, the finger could easily be introduced through the dilated urethra into the bladder. The stone was three inches long and four inches and a quarter in greatest circumference. The patient recovered.

When the calculus is small enough to pass without injury, or when it is lodged behind the contracted external meatus, and is cylindrical or narrow and fusiform, it should be removed by simple traction and pressure, or, if necessary, by dilating and incising the external meatus. Soft phosphatic calculi may be broken by crushing with forceps, and so removed piecemeal. A large stone projecting into the urethra from the bladder should be removed from the bladder by a vaginal or a suprapubic incision. In other cases it is better to extract the stone by making a longitudinal incision through the vagina into the urethra or into the urethral sac in which the stone lies.

This was done in a case of Serfioti reported by Piaseski (*Nouv. arch. d'obstet. et de gynécol.,* 1892, p. 236). The patient, sixty-five years old, began to experience discomfort twenty-five years before, immediately after her last confinement. For three years she had suffered intensely with painful micturition, passing her urine as often as ten times daily and almost as often at night. Upon examination, 1½ cm. from the meatus a densely hard, incompressible angular mass was felt in the anterior vaginal wall, about as big as a hazelnut, painful on pressure, and movable. The urine contained a muco-purulent sediment. The stone lying in a pocket with a small orifice of communication with the urethra was not touched by the first sounding efforts.

An incision was made through the anterior vaginal wall 2½ cm. (1 inch) long over the calculus, through which it was extracted and the wound closed with a continuous silk suture. The calculus was pipe-shaped, the size of three little hazelnuts superimposed, and was made up of earthy phosphate. A complete recovery followed.

URETHRITIS.

Urethritis in woman is a disease quite common, but rarely noted, owing to the infrequent use of the endoscope by gynecologists. Moreover, many of the cases of urethritis are diagnosed symptomatically as "cystitis" or "irritation of the bladder." Inflammation of the urethra in the absence of such a local cause as a foreign body is usually due to the gonococcus, which lingers in the urethra as its seat of preference long after all traces of infection have disappeared from every other part of the genito-urinary tract. Sometimes the patient presents a history of an acute inflammation, but oftener there is no definite history of such an attack or some slight disturbance only is recalled.

Vaginitis, endocervicitis, and inflammation of the vulvo-vaginal ducts may be found coexistent with an old urethritis.

B. Tarnovski ("Vorträge über venerische Krankheiten," Berlin, 1872) in 750 cases of gonorrhea found acute or chronic urethritis in 286, or 38 per cent. Steinschneider (*Berl. klin. Woch.*, 1887, No. 17, p. 301), in a study as to the localization of the gonorrheal infection in 34 fresh cases, found gonococci in the urethra in all of them.

The secretion may be seen bathing the urethral orifice, or it may be discovered on separating the little urethral labia, or by milking the urethra from above downward, when a little purulent, or brownish, or bloody fluid will exude from the external orifice. This should be done before urinating, so that the secretion will not have been washed away.

The disease is particularly apt to linger in a chronic form in Skene's glands, which can be milked out by making the pressure from above downward, first on one side of the urethra and then on the other. One or two drops of thick pus will often exude from the orifice of the duct just inside the urethra, giving evidence of its source by adhering more to the side from which it was squeezed. Long after a gonorrhea is apparently well a fresh attack may start up by auto-infection from a chronic gonorrhea which has lingered in these glands.

Fig. 239 shows an abscess of the left margin of the urethra exuding pus, which has its origin in Skene's glands; it pushes the orifice forward as shown and displaces the urethral orifice to the right, giving it a crescentic form. This case was cured by incision with the cautery below and parallel to the urethra; the abscess cavity, which contained about 3 c.c. of thick yellow pus, was then burned out and packed.

In acute gonorrheal urethritis the symptoms are a persistent, intense burning, frequent urination with pain, and sometimes a discharge of blood. Vulvitis and vaginitis may be associated with them. In the subacute form the discomforts may be transitory and not serious.

It is important in all cases to examine the urethral secretion microscopically for gonococci, and confirmatory evidence will be gained if the presence of gonococci in the cervical secretions can be demonstrated. Should they be found in the cervix and not in the urethra the evidence would still be in favor of a gonorrheal urethritis.

The urethroscopic examination must be made in every case where the purpose of the examiner is not only to know the nature of the morbid condition, but its grade and its extent as well. The diseased conditions are found almost exclusively in the mucous and submucous tissues, and are more apt to be localized in the anterior or posterior portions of the urethra than in the middle.

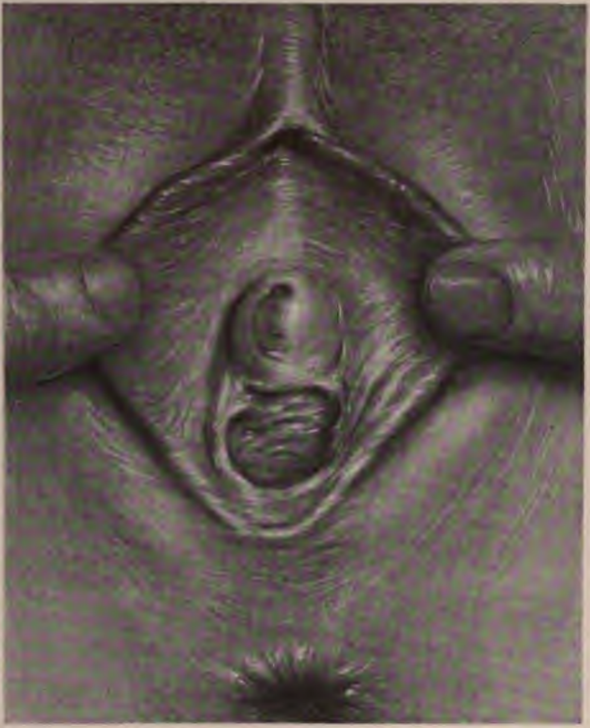


FIG. 239.—GONORRHEAL ABSCESS IN TISSUES TO LEFT OF URETHRA CHOKING THE ORIFICE AND DISPLACING IT TO THE RIGHT WHILE PUSHING SKENE'S GLAND PROMINENTLY FORWARD. SAN., NOV. 15, 1904.

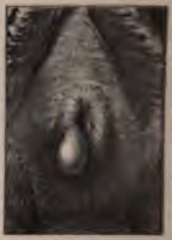


FIG. 240.—CONCEALED ABSCESS OF SKENE'S GLAND.

A drop of thick pus has been squeezed out of the right gland and lies upon the right labium urethræ. The orifice of the left gland is seen just inside the left labium urethræ.

In making a direct examination several precautions must be taken:

1. A small-sized speculum must be used (say a No. 8) in acute cases, in order to do as little harm as possible to the mucous membrane.

2. The external meatus must be well cleansed to avoid pushing any pus on the surface up into the urethra and bladder on the end of the obturator.

3. The manipulations must all be conducted with extreme gentleness and delicacy, so as to avoid producing lesions which might open up an avenue for septic invasion of the submucosa.

Acute Urethritis.—In florid gonorrhea, with a pouting swollen meatus secreting abundant pus, the examination may be foregone with advantage to the patient until the swelling of the mucous membrane has somewhat subsided.

If the examination is made, a strong solution of cocain should first be used to diminish the extreme sensitiveness of the mucosa, especially at the external orifice, which is swollen, red, and everted. Often here the little dilated orifices of a few glands can be seen exuding minute drops of pus. This condition is shown by the urethroscope to extend a short distance back, to be less intense about the middle, and often to assume a marked intensity again near the internal orifice. The use of the speculum always does some injury, making small fissures and producing slight hemorrhages.

Linear ulcers from 2 to 4 mm. long and 1 mm. broad are not rare on the inferior wall; they are painful and exhibit a yellowish area of necrosis in the center with an injected margin. The whole mucous membrane is deeply injected, and so swollen that it looks edematous, pouting into the lumen of the speculum and obliterating any distinct funnel form. Pus is seen abundantly between the mucous folds (see v. Janovsky, *Arch. f. Dermat. und Syph.*, 1891, p. 925).

Under the name urethritis externa Guerin has described a localization of the gonorrheal process which Dr. E. Finger ("Die Blennorrhoe der Sexualorgane und ihre Complicationen," Leipzig and Wien, 1893, p. 300) speaks of as follows: "The gonorrheal inflammation of the follicles at the orifice is either chronic, when there are no symptoms and a small amount of pus; or acute and relapsing. One or the other follicle swells, giving the urethral orifice an asymmetrical appearance, and the mucous membrane over the follicle is reddened. Soon a little point of pus appears. An abscess has formed in the follicle, and speedily opens, the pus escapes, and the follicle closes. In a short time the same thing occurs again in the same or another follicle, and so it continues for a long time.

"The only symptom of this unappreciated condition is some pain on touching the orifice. By a rupture of the abscess into the urethra and vagina simultaneously, a fistula is formed."

Chronic urethritis, the commonest form seen by the gynecologist, presents characteristic lesions easily noted through the urethroscope.

That the chronic form is a common sequel of the acute has been shown by the investigations of Finger and Janovsky (*ut supra*).

It exists in two forms:

1. The diffuse chronic urethritis is especially apt to follow on the acute form when located in the anterior part of the urethra. It is marked by small abscesses, especially involving Skene's glands, and by a diffuse chronic swelling in the anterior urethra. The funnel wall in these cases is thickened and pouts into the speculum; the central figure may be displaced laterally. The vessels are deeply injected, giving the mucosa a livid color. The mucosa in older cases presents grayish or slate-colored patches, 2 or 3 mm. in diameter. The disease is commonest in prostitutes.

Janovsky states that diffuse hyperplastic processes extend out on to the submucosa from the diseased Skene's glands.

2. Circumscribed Chronic Urethritis.—The subjective symptoms of circumscribed urethritis are mostly slight, often amounting to nothing more than an itching or burning sensation. The discharge is thin and contains but few gonococci; when the disease is localized in the glands it is known as glandular urethritis (Oberländer). Patches of deeply reddened mucosa are seen for the most part up near the internal and down near the external orifice. In these, particularly along the posterior wall, groups of yellow spots about half a millimeter in diameter are seen, surrounded by a reddened area. In a more advanced stage anemic streaks of scar tissue may be seen and the tissue resists the passage of the speculum, even tearing when more pressure is made.

Treatment of Urethritis.—No active local treatment should be undertaken during an acute urethritis. The patient must rest in bed and receive frequent hot vaginal douches; she must bathe the parts externally with lead water and laudanum and receive a belladonna suppository (0.03 gram), or if the pain is too great, an opium suppository. As soon as the acute stage has subsided, an iodoform suppository may be inserted once daily into the urethra with benefit.

The chronic form of the disease must be treated by exposing the affected areas and making applications of a 3 to 5 per cent solution of nitrate of silver at intervals of from three to five days. Skene's glands should be emptied daily by pressure from above downward on each side of the urethra. If there is a chronic diffuse inflammation about these tubules they should be laid open in the direction of the vagina, and their lining mucosa burned with a silver stick.

Ichthyol (the ichthyo-sulphate of ammonia), first employed therapeutically by Unna, in 1883, in cutaneous diseases, is now widely used as a gonococcocide, and Jadassohn vaunts its germicidal powers in a 1 per cent solution as more efficient than resorcin or permanganate of potassium, already much used. It has no toxic or irritant effect, and is best used in solutions of from 1 to 10 per cent strength. Jullien (*Internat. Cong.*, Rome, 1894) uses ichthyol with remarkable effect in urethritis in the following manner: A delicate piece of metal roughened for about 8 cm. (3 inches) of its length is wrapped in absorbent cotton, which is then soaked with an ichthyol and glycerin solution (1 to 10, or 1 to 5), and introduced into the urethra; by making pressure in various directions the folds of the urethra are effaced, the glands pressed upon, and the solution squeezed out of the cotton and brought into contact with all parts of the mucous membrane. At the same time that the urethritis is under treatment, gonorrhea of the vagina and cervix must be actively treated by vaginal tampons.

SUBURETHRAL ABSCESS.

There is a peculiar affection of the urethra about whose etiology we are still in the dark; it has been variously called "suburethral abscess," "abscess of the urethro-vaginal septum," "chronic abscess of the female urethra," "urethral urinary pocket," "urethral diverticulum," and "urethrocele." The essential features of the disease are an abscess cavity in the urethro-vaginal septum communicating with the inferior wall of the urethra. The disease presents itself as a symmetrical rounded swelling of the anterior vaginal wall beneath the urethra, varying in size from 2 to 3 cm. in diameter. It is sometimes ovoid and as big as a hen's egg, with its longest diameter in the axis of the vagina.

The enlargement begins 1 or 2 cm. behind the external urethral orifice, and may extend back to the base of the bladder; it is sharply circumscribed, and can, as a rule, be seen at once, filling the vaginal outlet, on separating the labia. In one case which I have seen, it was situated farther back toward the neck of the bladder, and was first detected by the finger recognizing a peculiar cushiony resistance at this point. The surface of the tumor is smooth, sometimes tense, and elastic or yielding to touch. If firm pressure is made upon the tumor it diminishes in volume as the contained pus flows out of the urethra. It is extremely painful when handled. A urethroscopic examination shows a deeply congested mucosa, and on withdrawing the speculum a few drops of pus suddenly gush into its lumen as it passes a certain point, and on moving it to and fro until the exact place is fixed, and elevating the handle a little to bring the floor of the urethra into better view, a small longitudinal fissure may be seen about the middle or a little behind the middle of the urethra. A probe passed through the speculum into this opening is felt *per vaginam* in the sac.

When these cases come into the gynecologist's hands the patients have, as a rule, been suffering for some years, and have often been treated for a long time for an irritable bladder. They are usually married women in the thirties, and complain of painful micturition, excessive pain in coitus, and a sense of discomfort and bearing down as if a foreign body were in the vagina. The patient herself often notices a discharge of pus from the urethra, sometimes fetid. In urinating, Huguier notes first an escape of pus, then pus and urine, and finally clear urine (*Mém. de la soc. de chir. de Paris*, 1847).

Huguier is supposed to have been the first to describe this disease, but curiously enough I have found the first real description in William Hey's "Practical Observations in Surgery," published in Philadelphia in 1805, p. 304. Hey gives a typical history as follows: "In 1786 Anne Miller came under my care as an out patient of the General Infirmary at Leeds for a node on the tibia, which I suspected to have had a venereal origin. When she was about to be discharged cured, she informed me that she had been troubled for fifteen or sixteen years with sudden and irregular discharges of purulent matter from the vagina. These discharges, she said, were frequent, and sometimes considerable, yet she never perceived any matter to be mixed with her urine.

"Upon examination, I found a roundish tumor at the os externum, appearing to be formed by an enlargement of the bulbous part of the urethra. When the tumor was compressed pure pus issued from the urethra, yet her urine, when drawn off with a catheter, did not contain the least mixture of purulent matter. Upon introducing a bent probe into the urethra, I could easily push

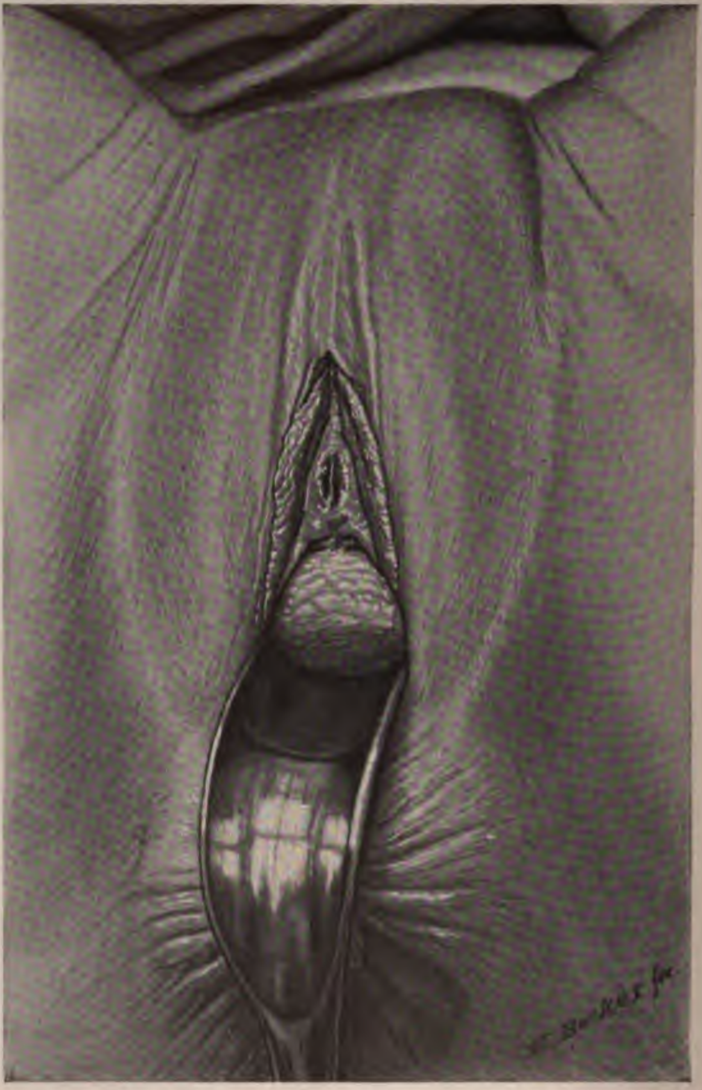


FIG. 241.—LARGE SUBURETHRAL ABSCESS OCCUPYING THE ANTERIOR VAGINAL WALL AND DISCHARGING PUS INTO THE URETHRA THROUGH A NARROW SLIT NEAR THE INTERNAL URETHRAL ORIFICE. OPERATION, JAN. 17, 1894.

it to the most depending part of the tumor, and I could feel the probe distinctly by a finger introduced within the vagina.

"I divided the tumor longitudinally at a time when it was distended with matter. That part of the vagina which I cut through was not thinned by the distention, but was rather tough. The cavity of the cyst was smooth. As the opening which I had made was depending, and as the removal of any part of the cyst would have been attended with difficulty, I only filled the cavity with lint. A small artery was opened by dividing the cyst, but the hemorrhage did not continue long. This patient recovered speedily, and got quite free from the complaint."

The microscopical examination of the sac in one of my cases (L. J. P., J. H. H., No. 3095, i, 17, 1894), a nulliparous colored woman, thirty-one years old, showed on the outer vaginal surface a typical mucous membrane, beneath which was connective tissue rich in oval and spindle cells, with numerous dilated blood vessels. The inner lining of the sac consisted of mucous membrane eroded in places, and beneath this were irregular aggregations of polynuclear leucocytes; the surface was rough, with many elevations and depressions. In some of the depressions irregular oval cells with small oval nuclei were found, either in short rows or scattered without order, appearing identical with urethral epithelium.

The clinical history would appear to indicate that the sac was a urethral diverticulum, probably starting in an abscess formed in one of the crypts on the floor of the urethra.

A wide distinction must be drawn between these sacs, with a small orifice of communication with the urethra, and cases of urethrocele, in which there is a bellying out of the entire posterior wall of the urethra, and vaginal cysts occupying the same position, but not sensitive, incompressible, and containing a viscid fluid. The vaginal wall is generally thinned over a vaginal cyst.

They must be distinguished, too, from a small abscess in one of the lacunæ of Morgagni which is not large enough to produce any swelling in the vagina, or a calculus, arrested or forming in the urethra and carried in a diverticulum, recognized by its density and the sensation of a stone communicated to the probe.

Trauma due to an injury in labor, where there is an abrasion of the mucous membrane, followed by the formation of a little urinary pocket, with decomposition of the urine and inflammation, may also be mistaken for a suburethral abscess. (S. Duplay, "Poches urineuses," *Archiv. gén. de méd.*, No. 146, 1880, p. 12.)

Treatment.—Four plans have been followed:

(*a*) Dilation of the urethra sufficient to introduce the finger and enlarge the fistula by forcing it into the sac, and so giving free exit to the accumulations.

(*b*) A simple longitudinal, vaginal incision into the sac with a knife or cautery.

(*c*) Exsection of an elliptical piece of the urethro-vaginal septum, including part of the sac wall, with or without suture.

(*d*) Exsection of the entire sac and closure of the wound.

v. Winckel (Billroth and Luecke, *Handb. d. Frauenkrankh.*, Stuttgart, 1886, Bd. iii, p. 361) had a case which, he says, took care of itself, the patient emptying the sac frequently and using lead-water applications.

The best and simplest plan to bring immediate relief is the old one of William Hey—a longitudinal incision into the sac. After benumbing the vaginal mucosa with a 10 per cent solution of cocain, the sac is split open from end to end with a knife. The sac wall may then be painted with a strong tincture of iodine and packed with lint. The excision of an elliptical piece prevents the edges coming together and gives freer drainage. In one of my cases I split the vagina and dissected out the urethral sac, with great difficulty on account of its intimate relations with all the surrounding parts and the free bleeding throughout. I then closed the longitudinal wound under the posterior urethral wall with a series of interrupted silkworm gut sutures. The patient recovered completely. I was not so fortunate in a second case in which union was delayed, leaving a urethro-vaginal fistula, which had to be closed by a subsequent plastic operation.

If the simple incision and drainage is not sufficient, the contracted sac can be just as well dissected out at a later date, removing a small oval piece of the vaginal wall, but taking care to leave enough tissue to close the defect left by cutting out the sac.

NEW GROWTHS FROM THE URETHRA.

The following forms of new growths have been observed in the urethra:

1. Caruncle.
2. Fibroma.
3. Carcinoma.
4. Sarcoma.

All of these affections are rare. Caruncle is the commonest form, cancer comes next, and fibroma and sarcoma are found with extreme rarity.

Caruncle.—Urethral caruncle, or vascular tumor of the meatus, was first described by Samuel Sharp in 1750 ("Critical Inquiry into the Present State of Surgery," 1750, p. 168). He says: "Small excrescences may occasion violent disorders in so tender an organ as the urethra. I have seen a notable instance in the urethra of a virgin, where they grew in small quantity upon the orifice of the meatus urinarius, and for many months had produced the most excruciating torment, which continued until I had totally extirpated them."

In the same year G. B. Morgagni wrote of a case in a post-mortem examination upon a girl fifteen years old "*Ex urethræ osculo corpusculum prominebat rubellum*" ("De Sed. et Causis Morborum," *Lib. iv. de morb. Chir.*, Ep. 50, 51, first edition, Venice, 1751).

Since this time English writers in particular have devoted much attention to this affection.

The growth is usually seated upon the external orifice of the urethra somewhere on the lower half; it is of a florid or a dusky-red color, and is attached to the margin of the urethra by a pedicle or by a broad base, which sometimes extends up into the urethral canal. The appearance varies greatly. Sometimes it is flat and rugose, but slightly elevated, and looks much like a raspberry;

at other times nodose, or, as in the accompanying plate, the tumor is narrow, with a pedicle and a sharp, crenated edge, and stands out from the urethra with its long axis vertical, compressed by the labia on the sides.

Histologically the tumor is made up of connective tissue and hypertrophied papillæ, with numerous dilated vessels. It is covered with pavement epithelium. The presence of any unusual number of nerve fibers or any unusual arrangement of the nerve endings has not yet been satisfactorily demonstrated, although this statement of Sir J. Y. Simpson (" Clin. Lect. on Dis. of Women," Phila., 1863, p. 137) is still largely quoted: " The late Dr. John Reid once examined for me most carefully with the microscope a very sensitive and painful caruncle which I had removed from a patient, and he came to the conclusion that there was a very rich distribution of nervous filaments in it."

The clinical history of a urethral caruncle is a striking one. While some of them are painless, the majority cause exquisite pain during urination. One of Simpson's patients suffered so that she was in the habit of going some distance from the house to urinate, so that her moans and screaming might not be heard. Another patient, a young girl at puberty, would hold her water for twelve hours at a time to escape the pain of passing it, looking foward with horror to the time when the bladder must be emptied. In married women the sexual relation is often intolerable. From the site of the growth the pains radiate up through the pelvis into the bladder, vagina, and uterus, and down the thighs. The wear and tear of the extreme suffering on the nervous system is so great that the health may be completely wrecked, and the patient does little else than nurse her misery.

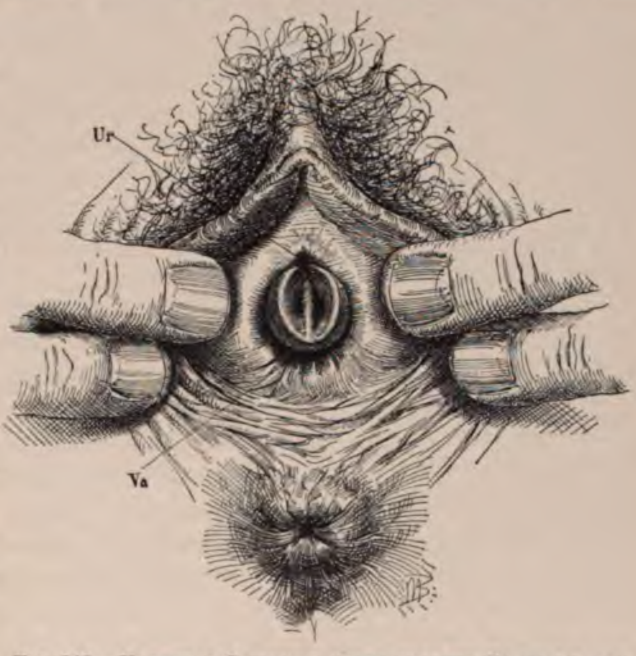


FIG. 242.—URETHRAL CARUNCLE OCCUPYING THE POSTERIOR AND LATERAL MARGINS OF THE URETHRA (*Ur*) AND LYING IN FRONT OF THE VAGINAL OUTLET (*Va*).

The growth is crescentic, and concave on its inner surface, and has a broad base with a narrow outer margin. It is smooth and glistening, slightly papillary, pink at its base, and deep red at the outer margin. Path. No. 1356. OCT. 24, 1896.

William Goodell (" Lessons in Gynecology," Phila., 1879, p. 26) presents a typical picture of an extreme case—that of " a young married woman who was broken down in mind and body by her sufferings. She was peevish, morose, and melancholic, and had dysmenorrhea and every imaginable a Coitus had not been indulged in for months, and she had taken to her l Neither her medical attendant nor myself could believe that the presence o urethral caruncle satisfactorily accounted for pale lips, hollow cheeks, sunl eyes, and for her grave mental and physical manifestations. . . . Yet af we removed the caruncle she became another woman. As if by magic, all l pains and aches, even her dysmenorrhea, left her."

When the growth is unusually vascular and its dilated vessels lie near surface, hemorrhages are frequent and may become alarming.

The diagnosis is readily made upon separating the labia and inspecting external genitalia, when the striking red excrescence at the urethral orific at once noted. If the patient is examined first by touch, the finger may re the seat of the suffering; but as a rule she will shrink so from the exam tion that the examiner will be unable to bring the finger into contact v the parts, and will be apt to be misled into concluding it is a case of vagi mus. Dysmenorrhea and ovarian disease are among the commonest mist made when the diagnosis is based on the patient's description of suffer which she may be unable to locate precisely. Cystitis is also often erroneo thought to be present after the loose fashion of diagnosing diseases of bladder in women.

The treatment must look to the complete extirpation of the gro Anything short of its entire removal will almost certainly be followed l return after a few months or longer.

Galvano-puncture was used with eminent success by the late Dr. L. Sweetnam, of Toronto, Ontario. The growth is covered with a 10 per cent s tion of cocain for five minutes, and then the galvanic needle is plunged int most prominent part down to the base from five to ten times, according t size. This has the immediate effect of blanching it and causing it to dimi in size. The treatment is painless, and may be repeated one or more ti until the entire mass has disappeared.

The use of caustics, which has been advocated in the past, is to be enti rejected on account of the subsequent dangerous cicatricial contraction of urethral orifice.

The removal with the knife, followed by suture, is the usual plan of tr ment, but to be successful this must be thoroughly done. For a small pedunculate tumor anesthesia is not necessary, as the parts can be sufficie benumbed with cocain; but if the growth has a broad base or extends up the urethra, the operation must be done more deliberately and anesthesia u The growth is clasped in a pair of small fenestrated forceps, drawn forw and an incision made on all sides, 1 or 2 mm. from the base of the pedi then the pedicle is cut through, step by step, and the tissues approximate the direction of least resistance with a fine continuous catgut suture, cove in the raw surface as the growth is cut away. Any large, actively blee vessels must be tied separately with fine catgut.

Fibroma of the Urethra.—Connective-tissue growths in the urethra are rare. Judging by the few cases described, they would appear to occur with greater requency in little girls.

C. Hennig (*Jahrb. f. Kinderheilk.*, N. F., 1868, Bd. i, p. 101) notes a ase in which he was called to remove a growth from the genitals of a recently orn girl. It consisted of a fleshy, soft, pendulous tumor about the size and rm of a lupine seed, with a pedicle 3 cm. (1¼ inches) long and 2 to 3 mm. ick, and was attached to the posterior margin of the urethra; it was visible soon as the legs were separated. The little growth was removed with issors, with very slight bleeding.

Another case observed by the same author was that of a prematurely born rl 45 cm. (18 inches) long. A soft rose-colored mass, 4 mm. long and 5 by mm. thick, with a pedicle 3 mm. in length, hung down from the right ferior margin of the urethra. This little polypoid tumor was tied with string and cut off on the following day between the child and the ligature; ere was considerable bleeding. Microscopic examination showed that the owth consisted of a whitish connective tissue in almost parallel layers freently running into one another, so as to form numerous meshes, and proled with numerous long nuclei characteristic of connective tissue.

C. Mettenheimer (*Jahrb. f. Kinderheilk.*, N. F., Bd. vi, 1873, p. 323) orts a case similar to that of Hennig in which the little girl was six years l. He found on examination a soft, elongate, red body, compressed by the ia of both sides, secreting mucus and hanging down over the frenulum. e base of this tumor was attached to the inferior margin of the urethra and newhat crenated. At each side of the base were two little wartlike outwths connected with the larger mass. The growth became markedly sensie during the use of local applications, and was removed with difficulty on ount of the resistance of the child.

Microscopic examination showed on the surfaces several layers of pavement thelium with markedly granular cells. The stroma of the tumor consisted a thick connective tissue, whose fibrillæ were densely interwoven. Between fibers were numerous fine granules. At a later date the remainder of the ior, which was imperfectly removed at the first operation, was extirpated ler chloroform narcosis.

Dr. H. Hoening, of Breslau (*Berl. klin. Wochenschr.*, 1869), reports a of a large fibroid polyp attached to the inferior margin of the urethra, cing the vagina and projecting out beyond the vulva. I shall refer but fly to this case, as it belongs to a group of tumors of the urethro-vaginal um, included under urethral diseases with doubtful propriety.

The patient had noticed a year before a painless elastic swelling prong out of the vaginal orifice, looking like a bladder, and producing a tion of tension and occasional retention of urine. This grew rapidly she was finally obliged to be catheterized regularly. According to statement, a physician cut off a mass, as large as a child's head and weighing two pounds, fourteen days before she entered the gynecological clinic at Bonn.

Upon examination, a mass was found projecting from the genitals about the size of the fist, ulcerating and breaking down, and extending into and choking the vagina. It was the shape of a dumb-bell with the marked constriction under the pubic arch. At the operation the vaginal tumor was drawn outside by strong traction, when it was found attached to the anterior vaginal wall under the urethra by a short pedicle about as thick as the finger. This was cut through with scissors and the tumor removed. Some free hemorrhage was checked by ligatures. The vagina had been converted by the tumor into a large sac in its highest part, and was extensively ulcerated by pressure. The mass weighed nearly three pounds, and was 20 cm. (8 inches) long by 9 cm. (3½ inches) in breadth at the thickest place.

The microscopic examination was made by Prof. E. Rindfleisch, who reported that the tumor was an edematous soft fibroid without any admixture of suspicious elements.

Myoma of the Urethra.—Büttner describes (*Zeitsch. f. Geb. und Gyn.*, vol. xxviii, Part I, p. 136) a case of myoma of the urethra observed at F. Ahlfeld's clinic in Marburg in September, 1893.

The patient, forty years old, had had a sensation of pressure in the region of the urethra for a year back; four weeks before, she noticed a small tumor at the vulva, which apparently grew rapidly. No disturbance was produced by its presence other than the frequent evacuations of the bladder.

The examination revealed an ulcerated tumor the size of a hen's egg protruding from the genitals, which was separated from the clitoris by a broad area of sound tissue; the orifice of the urethra was converted into a crescentic slit 4 to 5 cm. wide, encircling the tumor on its under side. The anterior part of the urethra could not be distinguished, as the tumor was attached at that point. The base of the tumor was apparently covered with a thin connective-tissue layer, and numerous reddish fibers from the sphincter muscle of the urethra. The tumor was only moderately sensitive to touch. The firm circumscribed tumor of considerable size, distinctly attached to one part of the urethra, bleeding but slightly and not breaking down or bleeding under handling, differs in these important characteristics from a carcinoma or a sarcoma of the urethra. The extirpation was made without any difficulty by catching the projecting mass with forceps, pulling it forward, and cutting around it so as to split the capsule, which was then easily pushed back, much as a uterine myoma may often be shelled out of its capsule. There was scarcely any hemorrhage. The finger could be introduced into the pit in the anterior wall of the urethra at its external orifice, and back of this could be felt the firmly closed normal urethra. The patient made a rapid and complete recovery.

The microscopic examination showed that the tumor was made up almost entirely of the smooth muscle fibers of the urethra, with a minimal admixture of fibrous tissue.

Cancer of the Urethra.—Cancer of the urethra belongs to the rarer diseases and appears in two forms, either as a primary cancer, affecting, as a rule, at the outset the mucous surface of the urethra, or as a peri-urethral cancer.

In two cases of cancer of the epithelial surface of the urethra published by P. Reichel (*Phys.-Med. Ges.*, Würzburg, 1891, p. 48) the patients were both sixty years old, and the extensive carcinomatous affection of the entire urethra seemed to have taken its starting point at the external orifice, where the disease was most advanced.

Dr. T. G. Thomas (*Amer. Jour. of Obstetrics*, 1877, vol. x, p. 114), exhibited a cancer of the urethra of a patient, twenty-nine years of age, who two months previously had noticed a pinkish discharge from the vagina, increasing until it amounted almost to hemorrhage. Upon finding a growth at the orifice of the vagina she consulted a physician, who discovered a tumor as large as an English walnut projecting from the urethra. The tumor was removed, together with the entire urethra up to the neck of the bladder, and the specimen, examined by Dr. Francis Delafield, was pronounced to be carcinoma. The patient recovered, and had complete control of her bladder function.

v. Winckel (Billroth and Luecke's "Handbuch," 2d ed., Bd. iii, p. 381) describes two cases of primary urethral cancer. In one he was able to extirpate the isolated urethral tumor, which was 3 by 1 cm. in size. In its center was the urethra with its mucous surface broken down and ulcerated. Close to the external orifice the vaginal mucosa bordered directly upon the whitish-gray crumbling tumor mass, filled with yellowish spots. Plugs of pavement epithelium were separated from each other by bundles of muscular tissue. The tumor was separated from the vaginal epithelium by the normal vaginal mucosa containing an unusual number of leucocytes. In his second case, figured in his book (page 382), the patient had a carcinomatous urethro-vaginal fistula and a secondary cancer of the bladder.

In October, 1891, J. Schramm (*Centralb. f. Gynäkol.*, 1892, p. 236) exhibited, at the Gynecological Society of Dresden, a primary peri-urethral cancer removed from a patient fifty-six years old. The tumor was larger than a walnut, and caused incontinence. It was removed by scraping, and the surface treated with the Paquelin cautery.

In 1869 Melchiori and Riberi described five cases of peri-urethral cancer (*Schmidt's Jahrb.*, Bd. cxlvi, p. 314). They found that the peri-urethral cancer started in the vestibule close to the urethra and then developed in the cellular tissue inside the urethra, without affecting the urethral walls or mucosa. The nodules were hard and showed no signs of ulcerating at the beginning, but occasioned lancinating pain. In some cases they were ulcerated and bleeding when first discovered at a later stage of the growth.

I have myself seen two cases of secondary peri-urethral cancer. In both the urethra was converted into a small rigid tube, easily bleeding upon introducing a glass catheter into the bladder, and the patient suffered from extreme difficulty in emptying the bladder. In one of these cases the disease extended from a cancer of the labium majus down over the vestibule around the urethra; in the other, a small-celled cancer extended from the vault of the vagina down around the urethra, after an extirpation of the uterus and the upper vagina for cancer of the cervix, with metastases in the vault. The patient came back six months later, with a nodular infiltration of the rest of the vagina and an infiltration underlying the whole urethral tract, converting the urethra into a rigid tube.

Treatment.—The treatment of carcinoma of the urethra is by extirpation in all cases where the disease has not progressed so far as to make a radical procedure absolutely hopeless. The removal of the disease in its earlier stages, when it is confined to the neighborhood of the external orifice, is easy. This should be done with a knife, and the carcinomatous mass should be given a wide berth, cutting as high up in the vagina as it may be necessary. The vaginal mucosa can afterwards be approximated, and the vaginal and urethral mucosa sutured together to preserve, as far as possible, the normal caliber and direction of the urethra.

Thomas's case cited above shows that with destruction of the urethra, even down to the neck of the bladder, continence may still remain.

In the case operated upon by A. F. McGill (*Lancet*, 1890, p. 966) the cancer involved two-thirds of the urethra and the lower part of the bladder. It was treated as follows: The pelvis was elevated and the abdominal walls opened a half-inch above the pubis by a transverse incision three inches long; a transverse incision into the bladder under this was fixed to the skin by sutures to keep the bladder from dropping away. Then after putting the patient in the lithotomy position, the entire cancerous mass was removed with knife and scissors, an assistant pressing it down into the vaginal opening from above. A vaginal opening, made in the bladder by this excision large enough to admit two fingers, was closed by five sutures. On putting the patient again in the Trendelenburg position, the suspending sutures were cut and the suprapubic incision closed down to a small orifice left for drainage. The wound in the vagina broke down, leaving a vesico-vaginal fistula; but this healed spontaneously in thirty-seven days and the patient went home wearing a urinal.

Sarcoma of Urethra.—But four cases of sarcoma of the urethra have been described, affecting the external orifice.

H. Beigel ("Die Krankh. des weiblichen Geschlechtes," Bd. ii, Stuttgart, 1875, p. 654) cites the case in a patient, fifty years old, who suffered from pain and hemorrhages. The examination revealed a tumor made up of three vertical folds occupying the position of the urethra and projecting out so as to separate the labia majora, the whole mass being about the size of a walnut. The tumor was removed with scissors; the operation only occasioned a moderate amount of bleeding, which was checked by the application of chloride of iron. Beigel gives a picture of the tumor *in situ*, together with two pictures of the microscopic sections, showing that the tumor was a sarcoma.

E. Ehrendorfer describes a second case (*Centralb. f. Gyn.*, 1892, No. 17,

p. 321) very like Beigel's. The patient was fifty-two years old and past the climacteric. For eighteen months she had noticed an enlargement in the neighborhood of the urethral orifice, but it gave no trouble until shortly before the examination and treatment. Her attention was first directed to the swelling by the discharge of a bloody watery fluid without any bad odor. She also suffered, as in Beigel's case, from bleeding at coitus. An examination showed the tumor projecting out over the vulva, pushing aside the labia majora and minora. The mass was made up of several deep-red, injected, rounded, and cockscomb-like protuberances, divided, in general, by three deep sagittal fissures. In places there was a loss of the superficial epithelium, and a discharge of bloody fluid. Several small areas appeared edematous. The length of fold of the right side was 3 cm. (1¼ inches); of the left and middle folds, 4 cm. (1½ inches); the thickness varies from ½ to 2 cm. (⅕ to ⅘ inch); and the growth projected from 3 to 3½ cm. (1¼ to 1½ inches). These masses were attached to the inferior lateral margin of the external urethral orifice, and connected with some smaller masses surrounding the upper margin, so that the orifice was completely encircled and formed a distinct pedicle for the tumor. Between the larger masses, hanging down from the inferior orifice and the smaller masses above, the urethral opening was easily found. There was no infiltration, and no nodules were found in the surrounding tissue. The growth was moderately resisting and elastic.

The tumor was removed, at the request of the patient without anesthesia, by grasping it and drawing it forward moderately and incising the mucous membrane just behind the pedicle on all sides with a knife. Keeping up the moderate traction, the urethral mucosa was also cut through, and the whole mass completely removed. There was a moderate amount of parenchymatous bleeding, and only one vessel was tied. The urethral and vaginal mucosa were united with catgut sutures, and a dry iodoform dressing applied. The wound did not heal by first intention, but in four weeks the patient was discharged cured.

Microscopic examination showed that the smaller tumors on section appeared like lymphatic glands made of numerous small cells poor in protoplasm. Between the crowded cells in the thin places was a fine reticulated intercellular substance, more fibrous in some places than in others. Toward the periphery appeared scattered or grouped smaller round cells (small-celled infiltration). The tissue was vascular, and a few of the larger veins were choked with blood. The vessel walls were thin and without endothelium. The outer covering in the smaller tumors was made up of pavement epithelium, wanting in places, where it was replaced by flat granulations. The larger masses consisted in their deep portions of the same crowded round cells found in the small tumors. More superficially, however, there was a firmer, large-meshed stroma poor in round cells. In places the pavement epithelium was made up of many layers, and showed no atypical penetration into the depths of the mass. At no place was there any gland or gland-like outgrowth. With reference to the lymphoid cells poor in protoplasm, disposed partly in a network and partly in bands between intercellular substance without epithelioid character, and without alveolar arrangement, it is evident that the tumor was a small, round-celled sarcoma, closely resembling fresh granulation tissue. Free pigment found in places was evidently due to interstitial hemorrhages or blood-corpuscle columns.

Galabin (*Trans. London Obst. Soc.*, vol. xxxviii) also reports a case of "myxo-sarcoma of the urethra in a child."

The patient, a little girl three years old, was first admitted to the medical ward of the hospital, but, on account of hematuria, was transferred to the gynecological division. On examination a tumor was found between the labia extending from a dilated urethra. This tumor measured about three inches in both principal diameters, and the surface was bright red and lobulated. The growth was removed with the galvano-cautery, and after removal the urethra was found dilated enough to allow a finger to be introduced. The child died soon after leaving the hospital. Microscopical examination showed the tumor to be a round-celled sarcoma, myxomatous in places.

A case of melano-sarcoma of the urethra occurring in a single woman, aged sixty-four, is reported by Dr. C. A. L. Reed, of Cincinnati (*Amer. Jour. of Obs.*, Dec., 1896, p. 864).

The patient discovered the tumor herself some months previous to the examination upon suffering pain and noticing blood in the urine. After this there was a more or less constant pinkish discharge. At the examination a black, lobulated, eroded mass about 3 cm. in diameter was found separating the labia, with the urethra in its center.

Almost the entire urethra was removed with the growth, in spite of which the patient was able to retain her urine, and made an excellent recovery as far as the local condition was concerned. She died six months and a half later with a large nodular tumor filling the abdomen above the navel.

Microscopical examination of the urethral tumor showed it to be a typical melano-sarcoma.

DISEASES OF THE BLADDER.

Affections of the bladder may in general be classified as:

1. Those originating in some part of the bladder wall itself.
2. Those connected with its functional activity.
3. Those due to the extension of disease from some other organ.

The bladder is a thin-walled musculo-membranous sac, imbedded in connective tissue, and partly covered by peritoneum, and any disease originating in it must first involve one of the component layers of its walls, either the mucous, the muscular, the fibrous, or the peritoneal coats. The list of such purely local affections is short; we may have, for example, an inflammation of the mucosa, cancer of the mucosa, or myoma and fibroma of the muscular and fibrous layers. No disease limited to the small area of its peritoneal covering has as yet been observed. The physiological activity of the bladder as a recipient of the urine, as a reservoir, and as a detrusor urinae, render it liable to certain diseases depending upon pathological conditions of the urine.

Stones are formed in the bladder from nuclei which may be either transferred from the kidney or may originate in the bladder *de novo*. The bladder is also often inoculated by bacilli brought down to it from a tuberculous kidney. When there is an obstruction to the outflow of the urine the bladder walls become either abnormally thin or hypertrophied.

The topographical relations of the bladder, its continuity and contiguity with neighboring structures, are a fruitful source of secondary affections. A conspicuous example of this sort is the cystitis following a gonorrheal urethritis. The peritoneal covering is also often involved in any extensive pelvic peritonitis, and the bladder then forms adhesions to the uterus, to ovarian and tubal tumors, and even to the rectum. I have often seen these adhesions between the bowel and bladder so extensive as to bury the uterus completely out of sight.

When we come to look over the list of the diseases which are due to contiguity of tissue we find the bladder liable to participate in a variety of vaginal, uterine, tubal, and ovarian affections. As each of these organs exhibits a well-defined tendency toward certain peculiar affections, and only a limited portion of the bladder lies in contact with it, certain areas of the organ are in this way rendered more susceptible to particular affections, which are distinctly regional in character. A conspicuous example is the fistulous communication between the vagina and the base of the bladder. Again, that portion of the bladder which touches the cervix is apt to be invaded by cancerous disease extending from the uterus; ovarian and tubal abscesses may break through the broad ligament into the bladder posteriorly in the neighborhood of the vesical cornua.

The diagnosis of diseases of the bladder is made—

First, by careful study of the history and the symptomatology.

Second, by urinalysis.

Third, by direct examination, by palpation, and by inspection of every part of the illuminated inner surface under simple atmospheric distention, in the way described.

With the new and easy methods of diagnosis which at once separate the simpler from the graver cases, and the localized from the diffuse affections, rational plans of treatment may now readily be adopted, superseding the older ways.

First, topical applications can be made over small areas under direct inspection, even using strong caustic solutions, which would be dangerous if applied to the whole interior of the bladder.

Second, irrigation with medicated solutions is valuable in extensive affections involving almost the entire inner surface.

Third, ointments can be applied to the mucosa by inflating a rubber balloon.

Fourth, the snare and other instruments can be used to remove pedunculate growths.

Fifth, diseased areas can be excised, and sound tissues brought together by sutures.

Classification of Diseases.—It is important in taking up diseases of the bladder in women to avoid the old error of transferring to this field the clinical observations gathered in the study of the vesical diseases of men, for both the symptomatology and the frequency of the various diseases differ vastly in the two sexes. Many of the vesical diseases of women are entirely different from those of men, and the modes of treatment should be different also, on account of the different anatomical relations.

Diseases of the bladder in women may be classified as—

1. Congenital defects.
2. Displacements, with alterations in form and capacity.
3. Neuroses.
4. Foreign bodies.
5. Traumatic affections.
6. Inflammatory affections.
7. Neoplasms, benign and malignant.

CONGENITAL DEFECTS.

Congenital defects of the bladder are but rarely seen. They are (*a*) double bladder, (*b*) loculate bladder, (*c*) exstrophy.

Double Bladder.—This anomaly is due to want of fusion between the right and left parts of the allantois in early fetal life. Only a few cases are known to have occurred; the first is that observed by Gerard Blasius ("Observ. Medicae Rariores," Amsterdam, 1700, p. 59), in which a complete double bladder was found in an adult; his account of it occurs in his nineteenth observation, entitled "Another Example of Double Bladder." "At the post mortem of a man who died of phthisis in 1657, the outside of the bladder had a longitudinal depression extending throughout its length, and when the bladder was laid open a thick membranous septum was found completely dividing it into two cavities and extending down to the orifice of the single urethra, into which each cavity opened. Each of these cavities had but one ureter."

A similar case occurred in the practice of Dr. Alan P. Smith, of Baltimore, to whom the patient came for a stone in the bladder (see *Trans. Med. and Chir. Faculty, State of Maryland,* 1878, p. 91).

The patient was a middle-aged man with a double penis, separated by a deep sulcus above, and closely united below; on the right side there was a normal urethra beginning at the extremity of the glans; on the left side the urethral orifice was found just in advance of the scrotum; in front of this the organ was perfectly solid. On the surface of the organ and midway between the umbilicus and the pubis was an irregular smooth patch with a slightly concave surface not covered by true skin, formed by the wall of a partly extroverted bladder. The scrotum was normal and contained two normal testes. The patient urinated at will from the right or the left ureter, and doing this in presence of the doctor, he first discharged a quantity of clear amber-colored, healthy urine from the right side, and then immediately afterwards emptied the left side into a separate vessel, discharging ammoniacal urine, turbid with mucus and pus. The left urethral orifice was dilated and the stone removed from the bladder, after which the patient recovered.

Similar cases have been observed in young children, respectively fifteen days, two months, and twelve hours old, by I. Cattier, S. T. v. Soemmering, v. Winckel (Billroth and Luecke's "Handbuch," Bd. iii, p. 407), and F. Schatz (*Archiv f. Gynäkol.*, No. 1).

Cattier's case is clearly told (see Petri Borelli, *Obs. Med. rarae, Parisiis*, 1657, Obs. xx, p. 76). "An infant monstrosity with double urinary bladder and misplaced rectum and uterus. The aforesaid D. Rousseau related to me that he was called to open a cadaver of a child fifteen days old, in which he noted many abnormal things; for example, there were two bladders in the hypogastrium, separated by the breadth of a finger, into each of which one ureter passed directly."

Dr. Futh, of Metz, describes a case of double bladder (*Centralbl. f. Gynäkol.*, 1894, No. 14) in a boy of four months. The bladder was divided by a septum into right and left halves communicating by means of a small opening 5 mm. in diameter at the apex of the trigonum. A single ureter opened into each half. The urine of the right side was obliged to pass through the opening in the septum in order to escape. There was also a separation of the symphysis, a ventral hernia, and adhesions between the bladder and the rectum, as well as a lengthened meso-sigmoid.

Partial division of the bladder by septa extending a short distance into its lumen in the median line are not so rare.

Loculate Bladder.—Congenital loculi or diverticula forming smaller or larger pockets projecting like bosses on the outer surface of the bladder are not so rare. They are undoubtedly due to a defective development of the muscular wall of the bladder, allowing a part of the mucosa to be forced out between the bundles of muscles during the contraction. These anomalies are liable to be confounded with similar pockets which are the result of inflammatory diseases, and which not infrequently lodge calculi. They were also mistaken by the earlier observers for supernumerary bladders. A. Molinetti, for example, describes a woman with five urinary bladders ("Dissertationes Anatomico-Pathologicæ").

Blasius, too, just quoted, mistook such a case for a double bladder. In 1670 he examined a man of thirty, whose bladder just back of the urethra corresponded in all respects to a natural organ, but in its upper part, communicating by an extremely fine opening, was found a second bladder of less capacity. The relation of the two parts is clearly shown in his work on Plate VI, Fig. 11.

DESCRIPTION OF PLATE II.

Fig. 1.—Loculate bladder. The loculi are seen as deep depressions in the bladder wall surrounded by muscular bands in a state of contraction. The bladder mucosa is apparently normal.

Fig. 2 shows the same loculi with the muscular bands relaxed.

PLATE II.

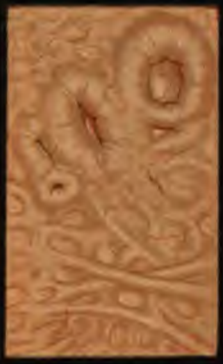


FIG. 1.

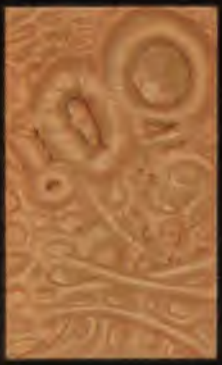


FIG. 2.

M. Brödel, fec.

is wanting. The recti muscles are widely separated, and a thin membrane between them covers in the abdominal cavity. Low down in the pubic region a rounded mass appears just above the position of the vaginal orifice, the size of a walnut or a fist, with its transverse diameter greater than the vertical; its color varies from pale rose to dark red and liver-like. The surface is irregular and wrinkled, or granular and indurated in patches; in fact, the whole external bladder looks like a spongy mass of excoriated flesh. The parts are covered

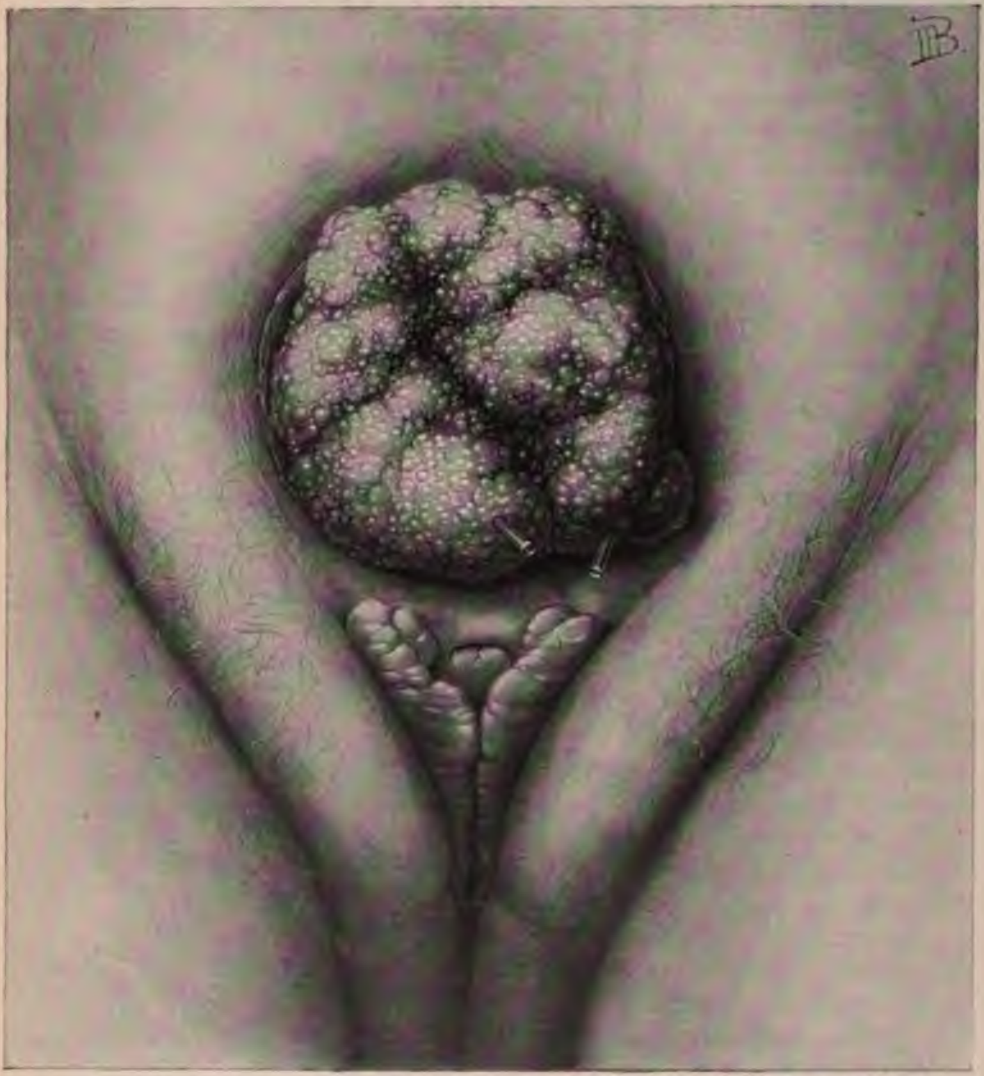


FIG. 243.—EXSTROPHY OF THE BLADDER CONVERTED INTO A CARCINOMATOUS MASS.

Catheters mark the ureteral orifices. The labia majora are widely separated and covered with sparse hairs; between the labia and below the bladder lie the separated halves of the clitoris, with the divided nymphæ to right and left. The vaginal orifice is marked by a transverse slit between the halves of the clitoris. ⅔ nat. size. Gyn. No. 4091. JAN. 18, 1896.

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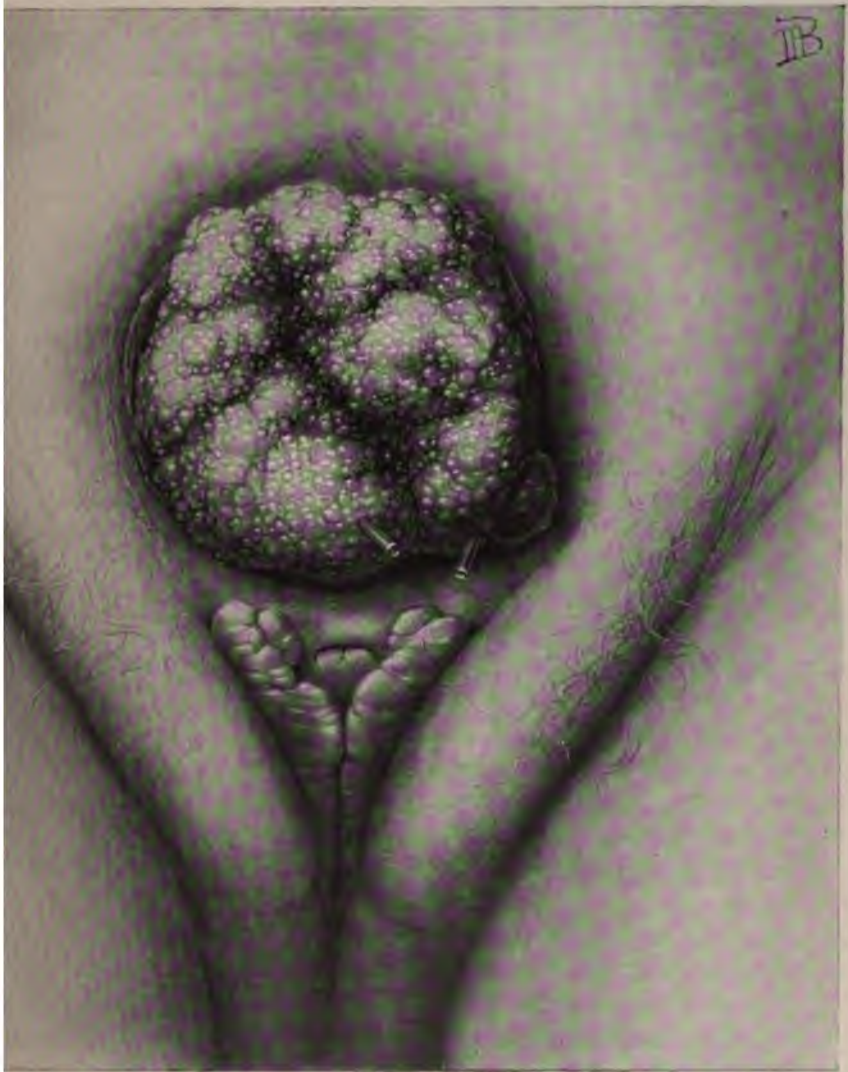

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ks like a spongy mass of excoriated flesh. The parts are covered

with slime and constantly wet with odorous urine. In children the sensitiveness is generally extreme. The ureters are seen each opening upon the surface of this mass, sometimes between mucous folds, sometimes on the apex of a marked elevation. The orifices discharge jets of urine at intervals, often projecting it a foot from the body. A sound carried into the ureter passes up to the kidney; and frequently a catheter may show a marked dilatation of the ureter above its vesical orifice. In girls the urethra is generally wanting. There may also be an atresia of the vagina and incomplete development of the uterus. Many of these cases are in other respects so malformed and puny that they are born only to die in early childhood; still a number have lived to old age, and several cases of pregnancy under these conditions have been observed.

C. C. T. Litzmann (*Archiv f. Gyn.*, Bd. v) and A. Gusserow (*Berl. klin. Wochenschr.*, 1879, No. 2) have studied with especial care the abnormal mechanism of labor, with separated symphysis, and without abdominal pressure. In Gusserow's case a dead child in foot presentation had to be extracted on account of the inability of the mother to complete the labor without the assistance of the abdominal muscles.

In a case of a girl of fifteen (G. T., J. H. H. No. 3869, October 14, 1895) the pubic bones were separated 4 cm. with a thin, sharp-edged fibrous band between them; above this there had been a total defect of the anterior bladder wall, covered in by inverted flaps of skin taken from the sides, and so adapted as to leave only a small orifice opening just above the fibrous band, through which all the urine escaped. By a rectal examination I found an infantile uterus and small ovaries, and on making a cystoscopic examination through the orifice left between the flaps, two little oval openings representing a double hymen were discovered on the posterior wall of the bladder; a sound passed through them led up to the cervix uteri.

An exstrophied bladder may become carcinomatous, as shown in Fig. 243.

Treatment.—Success in the treatment of exstrophy will vary according to the extent and position of the defect. Where the opening is high up and not accompanied by any defect in the genitals and lower part of the urinary apparatus, a cure may be effected by a careful funnel-shaped denudation around the opening and side-to-side approximation with silk or silkworm gut sutures. If the urethra is normal and there is no obstruction to the escape of urine by this avenue, this simple plastic operation, analogous to that done for vesicovaginal fistula, ought always to succeed. Where the defect is extensive and a urethra is absent a complete cure is unattainable. The best that can be done is to cover and protect the raw mucous surfaces with flaps from the neighboring skin, reducing at the same time the size of the orifice through which the urine discharges. The operator would better avoid turning in the skin surface, on account of the urinary incrustations which are likely to form on the hairs and keep up a constant irritation. Where a urethra is wanting, no satisfactory substitute for its function can be formed.

For closing in the defect in the abdominal wall the following plans have been successfully tried:

First, by taking three skin flaps from the sides of the opening, one above, and one from each side, leaving them attached by a broad pedicle; the flaps must be large enough to allow for a decided subsequent contraction. They are brought across the orifice and sewed together accurately, closing the defect.

Billroth's plan of treating exstrophy is to loosen up two broad lateral flaps left attached both above and below. These flaps are dissected loose by cutting down to the fibrous aponeurosis overlying the recti, so as to be sure to have enough thickness of tissue to preserve their vitality; then, in about two weeks, when the under surface is freely granulating, they are drawn together and united in the median line over the bladder. If the flaps are made broad enough, it is not necessary, as a rule, to close the openings left at the side, for in five or six weeks they will close of themselves. No attempt is made to close the fistula left above at the navel until after the artificial urethra has been made; then the umbilical fistula is closed by denudation and suture.

DISPLACEMENTS AND ALTERATIONS IN FORM.

The bladder in women is liable to a remarkable series of peculiar displacements and alterations of form in its effort to carry out the function of a urinary reservoir in spite of a variety of hindrances.

In determining the existence and extent of such abnormalities, the normal conditions must be borne in mind as the sole standard of comparison, and it must not be forgotten that while the male bladder is more or less spherical and has its greatest diameter in the antero-posterior direction, the greatest diameter in the female bladder in moderate distention is transverse, owing to the increased resistance to its expansion backward furnished by the uterus and broad ligaments.

The uterus lying in normal anteposition forms an indentation in the median line of the distended bladder, which can be touched and recognized by a sound introduced through the urethra. The physiological peculiarity in the form of the female bladder disappears after the removal of the uterus, and the male type is assumed with its greatest expansion from before backward.

In marked distention the female bladder rises into the abdomen and has its greatest diameter vertically, when the vault of the bladder may even reach the umbilicus and the distended organ appear like a large monocystic tumor springing from the pelvis. A case of this kind was brought several hundred miles to see me, expecting an operation for an abdominal tumor. The tumor collapsed as soon as a catheter was introduced, and a large basin of ammoniacal urine was withdrawn.

In another case, by palpation, percussion, and bimanual examination, a monocystic pelvic tumor, rising well up into the abdomen, had been demonstrated, and the patient was brought under anesthesia for operation. Upon passing a cathèter, a large amount of limpid urine was discharged and the tumor immediately collapsed.

Lateral Displacement.—The distention of the bladder may also take place markedly to the right or to the left side, giving it a gibbous form and making it more liable to be mistaken for a fluctuating tumor connected with the broad ligament. This obliquity of form can be easily demonstrated by passing a sound, which goes in 10 or 11 cm. outward and backward on one side and but 6 or 7 cm. on the other. These lateral obliquities are produced by any obstacle to expansion, such as an inflammatory mass or a tumor fixing one broad ligament.

An **upward displacement** of the bladder not associated with distention is noted in numerous cases in which a large uterus fills the pelvis and the lower abdomen. The most frequent cause of this form of displacement is a fibroid uterus in which both the cervical and fundal ends are involved; the top of the bladder may even come to lie on a level with the umbilicus flattened out on the anterior face of the tumor mass. The simple choking of the pelvis by a mass is sufficient to force the distending bladder up into the abdomen. Among a large number of such cases of upward distention I have seen but one where there was a great hypertrophy of the bladder walls. In cases of upward displacement a moderate amount of fluid in the bladder is often visible to the eye, forming a cushiony prominence on the tumor above the symphysis, fluctuating on palpation.

Downward displacement of the bladder is found in cases with a weak pelvic floor, with relaxed outlet, or where the intra-abdominal pressure is excessive. This displacement is also found in extreme prolapse of the rectum, drawing the posterior vaginal wall well into the sac, and dragging the uterus and the anterior vaginal wall down with it. Where there is a gaping vaginal outlet, the base of the bladder pouts into it as a soft, round, ovoid prominence, yielding to touch, and easily displaced by pressure; the swelling diminishes when the bladder is emptied and returns again as soon as it is distended with urine, or when the patient stands on her feet and the intra-abdominal pressure is exerted. This form of displacement is appropriately called "a cystocele."

Pari passu with the displacement of a prolapsed uterus, that part of the bladder which is attached to the anterior vaginal wall and the lower part of the uterus is likewise displaced, escaping with the vagina and the uterus outside of the pelvis (see Chapter XXII). A portion of the bladder remains within the abdomen and a part in the prolapsed sac; in this way the organ assumes the form of an hourglass. The entire bladder is rarely found within the prolapsed sac, and even then any marked degree of distention must take place in an upward direction. In rare cases the bladder becomes completely detached from the vaginal wall and uterus in prolapsus and remains entirely inside the pelvis.

I reported a case of this kind (*Johns Hopk. Hosp. Rep. on Gynecology*, 1892, vol. ii, p. 311) where a large prolapsed sac lay between the thighs, and in front of and behind the uterus were masses of intestines (anterior and posterior enterocele), while the bladder, completely detached from its vaginal and uterine detachments, lay within the pelvis.

Eversion of the bladder through a dilated urethra is the most unusual form of displacement. In eversion both mucous and muscular layers are involved, and the tumor appears between the labia as an ovoid, red mass covered with furrows. A careful examination of the under surface may show the presence of the ureteral orifices. The causes of the eversion are, an increased intra-abdominal pressure, associated simultaneously with a relaxation of the bladder wall and dilatation of the internal urethral orifice. That part of the bladder which lies opposite to the internal urethral orifice, the posterior pole, is first engaged, and, under the influence of straining efforts, forced down through the urethra, dragging more and more of the viscus with it until the whole organ is turned inside out. Eversion is observed oftener in young children and in the aged.

The bladder may also be displaced by being drawn into the inguinal and femoral canals, and even through the foramen ovale with herniæ.

Diagnosis.—The diagnosis of the form of displacement of the bladder in any given case is not difficult. After distention with fluid a bimanual palpation will outline the different parts, and by means of a graduated sound, introduced *per urethram*, measurements made in various directions will determine the exact form.

The diagnosis of an eversion of the vesical mucosa must be made under anesthesia by carefully examining the tumor protruding from the dilated urethra, and if a sound is passed through the urethral canal, the bladder cavity is found to be absent and the pedicle of the tumor at the internal urethral orifice. On pushing back this mass, the bladder cavity is restored, and, if the urethra is sufficiently dilated, the absence of any tumor is demonstrated by introduction of a finger.

Treatment.—The treatment of the various displacements of the bladder often resolves itself into the treatment of the associated conditions which have caused the displacement. By removing ovarian tumors choking the pelvis, and inflammatory masses lateral to the uterus, the free distention of the bladder within the pelvis once more becomes possible. By removing a fibroid uterus the bladder is let down to its normal pelvic position.

Other displacements are treated by repairing the relaxed vaginal outlet so as to lift up the pelvic floor and give an adequate support to the anterior vaginal wall; I rarely find it necessary, as was the custom ten years ago, to operate upon the cystocele itself. In prolapse of the uterus the bladder is restored to its normal position by the operations upon the uterus and the pelvic floor, retaining the uterus in its normal position.

In treating eversion we must, in the first place, put the bladder back into its normal place by elevating the pelvis in the knee-chest posture after which with gentle compression and manipulation the tumor may be forced back into its proper position. The patient should then be kept in bed, with the foot of the bed elevated, to reduce the pressure on the pelvic viscera. If the displacement persists in returning, a plastic operation may be performed, narrowing the urethra by placing a catheter in its canal as a guide for the size of a new urethra to be formed, and then excising a wedge-shaped piece with its base on the vaginal surface extending through to the urethral mucosa. The denuded surfaces are then brought together by interrupted sutures passed from side to side.

FOREIGN BODIES IN THE BLADDER.

Varieties.—A variety of foreign bodies are found in the bladder. They may form in the bladder itself, as in the case of vesical calculi; or they may reach the bladder from the exterior, by perforating its walls, by descending a ureter into the bladder, or by being introduced through the urethra.

The commonest foreign bodies are calculi, formed of incrustations of phosphates and urates. Small oxalic acid and uric acid calculi may descend from the kidney, lodge in the bladder, and grow there to a large size by the accretion of phosphates and urates.

Foreign bodies may also enter the bladder from the side of the peritoneum, the tubes, or the ovaries, as well as from the vagina. In this way echinococci have ruptured into its cavity; silk ligatures about the pedicle of an ovarian tumor have ulcerated through its walls; dermoid cysts have opened and discharged quantities of hair by the bladder; and the bones of an extra-uterine fetus have also found an exit in the same way. The commonest foreign body which makes its way into the bladder from the vagina is a pessary, usually of large size, which has ulcerated through the vesico-vaginal septum.

By the urethra a large variety of foreign bodies have been introduced; these are usually several inches long, and of a caliber somewhat smaller than the urethra. The commonest object is a bit of a catheter broken off or an entire catheter which has slipped out of the fingers and so entered. Other articles which have been found have been introduced by the patient herself, such as hairpins, toothpicks, crochet needles, etc.

The **symptoms** produced are at first those of irritation of the bladder, followed later by inflammation.

The patient complains of a suprapubic pain and a frequent desire to urinate: the urine becomes cloudy, and pus soon appears. In a few weeks the foreign body becomes incrusted with urine salts, when the symptoms of cystitis become more urgent and the distress increases.

A small foreign body, such as a renal calculus, may only lodge temporarily, and with its spontaneous escape by the urethra the symptoms cease.

Bodies of an elongate form, if large enough to put the bladder walls on the stretch, will ulcerate through, either into the vagina or into the peritoneum, in the latter case producing a rapidly fatal peritonitis.

Diagnosis.—The presence of a foreign body in the bladder may be determined either by touch or by inspection. If the body is long, or is of large size, it may often be easily felt bimanually by palpating the emptied bladder between two fingers in the vagina and the hand pressing down over the symphysis. Upon passing a sound into the bladder the presence of the foreign body may also be demonstrated by the sense of contact with a hard body, as well as by the audible click produced upon striking it.

The simplest and surest way to make a diagnosis is by inspection. The patient is put in the knee-chest position and the vesical speculum introduced, after which the bladder, distended with air, is easily examined in all its parts as already described. If there is any foreign body present which is not wedged in between the bladder walls, it will drop into the most dependent part, where it is most easily seen. By means of inspection the diagnosis of the absence or presence of a foreign body can be made with certainty; by this means also its form and position are noted, together with any alterations produced in the bladder walls by its presence.

Fig. 244 shows a vesical calculus as seen in the bladder through the open cystoscope illuminated by the light reflected from a head mirror. The patient in this case began to suffer from a severe cystitis after labor. The infection was manifestly due to the traumatism produced by the head of the child crushing the bladder walls against the unsuspected stone. After considerable futile treatment the patient was sent to me, when upon examining the bladder in the knee-chest position, I at once discovered the calculus shown in the figure. The operation for the relief of the hitherto rebellious complaint was almost as easy as the diagnosis, and the cure was prompt and permanent.

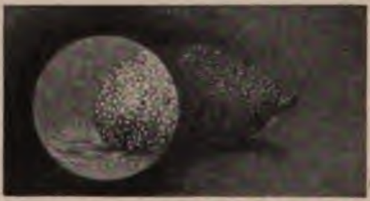


FIG. 244.—VESICAL CALCULUS, AS SEEN THROUGH SPECULUM. $\frac{2}{3}$ NATURAL SIZE.

Treatment.—The treatment in every case is directed to the speedy removal of the foreign body. There are three ways of doing this: (1) Through the intact urethra, (2) through an incision in the bladder walls made through the vagina, and (3) through a suprapubic incision.

1. A small foreign body not more than 10 or 15 mm. in diameter and a long narrow body, such as a needle or a glass catheter, may be removed through the vesical speculum. The bladder being empty, the speculum is introduced with the patient in the knee-chest position, and the object exposed. If it is a small round object it may be picked up by the alligator forceps and simply lifted out through the speculum, or it may be caught in a scoop, held against the end of the speculum, and withdrawn together with the speculum.

A long body like a glass catheter may be removed by introducing a straight instrument, such as a searcher, into the open end, and then manipulating the end of the speculum until the foreign body slips into it; then by pushing the speculum well down on the catheter engaged in this way, its end can be easily caught and withdrawn.

The older writers were wont to try to deliver a calculus through the urethra by catching it between the fingers of one hand in the vagina, or in a virgin in the rectum, and the other hand pressing down above the symphysis, and so forcing it into the urethra and on out.

I succeeded in July, 1895, in removing a glass catheter in this way. The patient was a young woman, about twenty-three years old, with a spherical myomatous uterus filling the pelvis and reaching up to the umbilicus. She had been suffering from retention of urine, and as her physician introduced a glass catheter 13 cm. (5 inches) long into the overdistended bladder, it slipped out of his fingers and was lost in the bladder. When I examined her I found the myoma and a long rigid body in front of it, with its blunt end projecting into the anterior vaginal wall to the right and its upper rounded end pressing upward directly under the anterior abdominal wall, 4 cm. below the umbilicus. The hymen was relaxed, so that by careful manipulation with two fingers in the vagina I was able to push the lower end of the catheter upward while pushing the upper end to the right; by doing this I brought the end into the urethra, when it descended at once, and escaped with a quantity of bloody urine. The patient suffered no further inconvenience from its twenty-four hours' stay in her bladder.

Bodies from 10 to 20 mm. in diameter may be removed through the urethra after dilating it. Simon has shown that even after a dilatation of 2 cm. incontinence does not occur if it is carefully done. Two postero-lateral incisions, 2 or 3 mm. deep, must be made into the external urethral orifice to avoid tearing it when the dilatation is carried up to 20 mm. or near it; the rest of the urethra, which is more elastic, is then enlarged by a series of successive dilators up to the required size, and the foreign object is either removed through one of the larger specula or grasped by a pair of small stone forceps introduced through the urethra and so withdrawn. The lateral incisions in the urethral orifice are then closed with fine catgut sutures.

Calculi, like other foreign bodies, may be removed either by the urethra, by vaginal incision, by suprapubic incision, or by crushing with the lithotrite.

Stones from 2 to 3 cm. in diameter should be crushed by means of an instrument introduced through the urethra. If the bladder is first moderately distended with water and a lithotrite inserted, the stone is readily caught in the open beak of the instrument and broken up; the pieces are afterwards removed through a speculum from the bladder which is distended with air.

Dr. H. J. Bigelow's apparatus for litholapaxy, which has served so well in men to reduce the number of cutting operations, by both crushing and washing out the bits of stone, is also available and even easier of application in women, although it has never been widely used on account of the great simplicity of the older operation through the short urethra.

Dr. E. T. Caswell, of Providence, R. I., reported a case (*Med. News*, Aug. 26, 1882) in which he crushed a phosphatic stone weighing, when dried, 100 grains. He used a modified Thompson's fenestrated lithotrite, and washed the fragments out through a straight tube (28 French).

Dr. D. F. Keegan (*Lancet*, Jan. 9, 1897) in an instructive article on "Litholapaxy in Girls and Women," reports eighteen cases of calculi occurring in women, where he used the lithotrite with success. The calculi were of different varieties—namely, phosphatic, oxalate of lime, and uric acid; the smallest weighed 72 grains and the largest 702 grains. The average length of stay in the hospital was only 5.3 days.

Although nature and art have succeeded in removing stones of large size by the urethra without any diminution of their volume, this is a hazardous procedure, and ought not to be imitated, on account of the imminent risk of a permanent incontinence following.

An extreme case of this sort is reported by Dr. Alexander Dunlap, of Springfield, Ohio (*Amer. Jour. of Obst.*, vol. xiv, p. 853); upon examining the patient, who was twenty-eight years old, he found a large stone 2 by 2⅛ by 1½ inches in diameter in the bladder; she would not allow any cutting operation to be done, so he caught the stone with a pair of forceps introduced through the urethra, and delivered it slowly by traction. The external meatus was the most resistant portion, but he succeeded in working it through in about three-quarters of an hour, by pressing back the tissues over the stone much as an obstetrician may try to help the perineum back over the advancing head of the child. The stone was rough on one side and tore the mucous membrane of the canal considerably; this produced a sharp venous hemorrhage of short duration. In spite of this enormous dilatation, she suffered no serious inconvenience, although unable to hold her water as long as before.

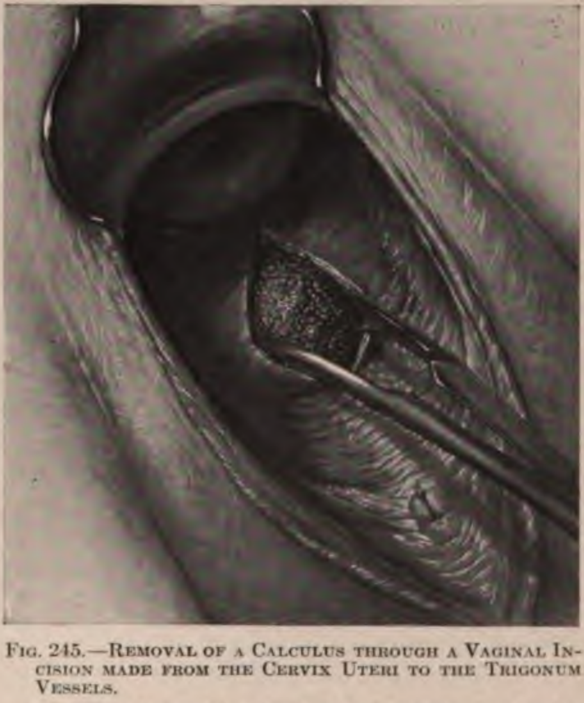


FIG. 245.—REMOVAL OF A CALCULUS THROUGH A VAGINAL INCISION MADE FROM THE CERVIX UTERI TO THE TRIGONUM VESSELS.

The method of making the incision is described on p. 412. (Sänger, MARCH 20, 1899.) Natural size.

2. The vaginal incision is to be preferred for stones which are so large that they can not safely be removed through the urethra, and is adapted to all but the largest calculi.

The operation is best conducted with the patient lying in the left semi-prone position, with the posterior vaginal wall well retracted, so as to expose clearly the entire extent of the anterior wall from cervix to urethra. A blunt instrument like a male sound is now introduced through the urethra into the bladder, and the vaginal wall is pushed forward in the median line and cut through, opening the bladder; the incision is now extended by drawing apart the edges of the wound and cutting back toward the cervix and forward toward the neck of the bladder until it is large enough to permit the introduction of the blades of a pair of stone forceps, which are used to grasp the stone by its smallest diameter and draw it out through the wound endwise, without laceration of the tissues (see Fig. 245).

The incision must then be accurately closed with interrupted sutures either of fine silk or silkworm gut. If the bladder is then drained for five or six days the clean-cut vaginal wound ought to heal promptly, leaving no fistula behind. It is best to close the wound at once in this way, although even large wounds may heal spontaneously. Such a case is the one of Dr. F. R. Eccles, of London, Ontario, figured in the text. The patient introduced a hairpin into the urethra and it escaped into the bladder. She married soon after, and at her confinement a large foreign body was felt in the way of the head as it descended; it was pushed up, however, and the labor proceeded normally. Dr. Eccles was called in later and removed the hairpin, incrusted with large, fused twin calculi, through an incision in the anterior vaginal wall. No sutures were used to close the wound, which healed spontaneously within five weeks.

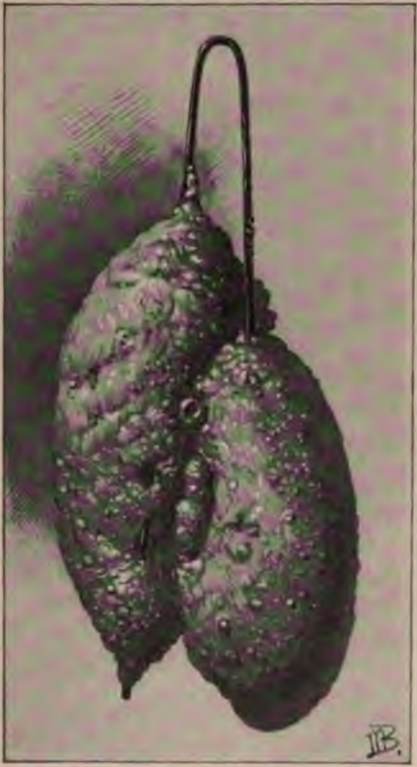


FIG. 246.—PHOSPHATIC CALCULUS FORMED UPON A HAIRPIN IN THE BLADDER.

3. The suprapubic operation for the removal of calculi (*sectio alta*) is best adapted to those of the largest size, which fill the bladder. It is especially suitable for children, where the vaginal route is not available.

After distending the bladder with water, a vertical incision 6 to 8 cm. long is made in the middle line just above the symphysis, separating the recti and the pyramidales muscles, and pushing aside the fat underlying them, but taking care not to cut the peritoneum. In this way the bladder is exposed, its wall cut through vertically, and the stone extracted. The incision in the bladder wall is now closed with fine interrupted catgut sutures, placed close together and embracing the entire thickness of the wall down to, but not including the mucosa. The incision in the abdominal wall is then closed with buried silver wire for the muscles and fascia and catgut for the skin. Then, if the bladder is kept well drained for a week, the wound in its vault will heal by first intention.

The stone which is shown in the figure was removed from a little girl only eight years old by Dr. F. R. Eccles by the suprapubic operation; the wound, which was not closed completely on account of the unhealthy condition of the vesical mucosa, healed spontaneously in four weeks.

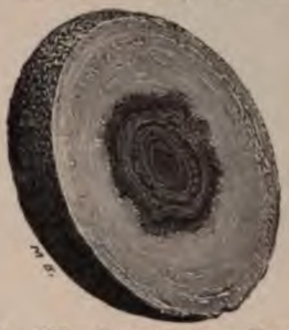


Fig. 247.—Section of a Vesical Calculus of the Bladder, Natural Size, removed from a Girl Eight Years Old.

VESICAL FISTULÆ.

Vesical fistulæ are abnormal channels of communication between the bladder and contiguous or adjacent organs; they are found, for example, (1) between the bladder and the vagina, (2) between the bladder and the uterus, and (3) between the bladder and some portion of the intestinal tract.

History.—It is a remarkable fact that no clear references to these common and distressing disorders are found in the earliest writers preceding the Christian era, nor for nearly sixteen hundred years afterwards. Toward the end of the sixteenth century and early in the seventeenth several clear descriptions appear almost simultaneously in the writings of Luiz de Mercado, a Spanish physician (1520–1600), Felix Plater (Basel, 1536–1614), and Severin Pineau (born in Chartres in the middle of the sixteenth century).

Plater (see I. Spach, *Gynaec.*, etc., Argent., 1597) gives two clear descriptions of fistulæ following difficult childbirths; the second case is appropriately entitled *vesicae cervicis alia ruptura in partu.* "As a sequence of a difficult first labor, a young country girl had the opening of the bladder rent to such a degree that there was a long gaping furrow in its place, and the open bladder could be seen. I have twice inspected it myself, and discovered that it was so by using a probe. On account of this injury there is a constant involuntary discharge of urine, and the surrounding parts become excoriated and inflamed."

H. v. Roonhuysen (1663) first proposed the closure of such a fistula by suture.

J. Fatio ("Wehe-mutter," Basel, 1752, p. 284) gives an admirable description of the way in which he twice carried this proposal out in the years 1675 and 1684 by placing his patients in the lithotomy position and exposing the fistula with a speculum; he then freshened its margins with a delicate pair of scissors, and brought the edges together by passing a sharpened quill through them and winding a thread over the ends of the quill to keep it from coming out. Both cases recovered.

A. J. Jobert de Lamballe (" Comptes rend. de l'Acad. des sci.," 1850, and " Traité des fistules," Paris, 1852) was the first operator who systematically took hold of this perplexing question and treated a large number of cases, many of them successfully. His plan of treatment for the simpler cases was to bring the cervix of the uterus down by traction with forceps so as to expose the fistula, following this by a broad denudation of the edges of the fistula and their exact approximation by interrupted sutures. When the fistula was a large one, and the approximation difficult on account of the tension, he made incisions in the lateral vaginal walls parallel to the edges of the fistula, so as to permit the tissues to be drawn together (" *par glissement* "). An incision through the vaginal vault detaching the cervix for this purpose has since been known as the incision of Jobert.

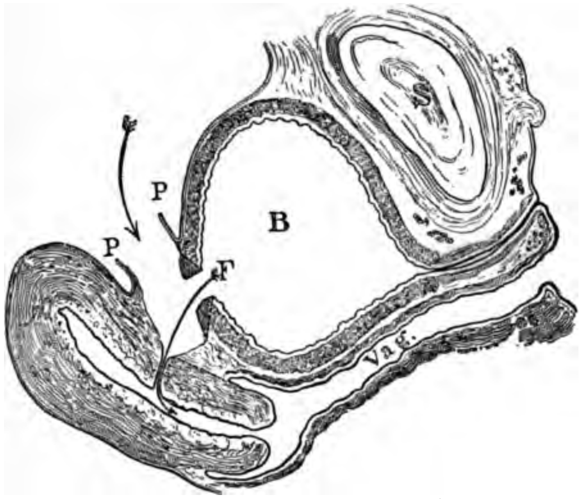


Fig. 248.—Treatment of Vesico-uterine Fistula by a Suprapubic Incision. (v. Dittel.)

The vesico-uterine peritoneum (P P) is divided, the fistula freed from the uterus, and its margins united by suture.

G. Simon (" Ueber die Heilung der Blasenscheidenfisteln," Giessen, 1854) did away with these lateral incisions, and substituted in their place a method with which his name is still connected, the use of a double set of sutures, one introduced at a distance from the wound for the relief of tension (sutures of detention), the other to secure accurate approximation (sutures of reunion).

J. Marion Sims (" On the Treatment of Vesico-vaginal Fistula," *Amer. Jour. of Med. Sci.*, 1852, vol. xxiii, p. 59), working independently in America, accomplished three things: (1) He devised the duck-bill speculum for the exposure of the fistula with the patient lying in the left semi-prone position; (2) he clearly described the best method of denuding the margins in a funnel form and down to, but not including the vesical mucosa; and (3) he sutured the edges of the wound accurately together with the non-irritating (antiseptic?) silver wire, and by this means, coupled with his great skill as an operator, he attained a degree of success in the treatment of these cases never before reached.

T. A. Emmet (" Vesico-vaginal Fistula," etc., New York, 1868, and " Principles and Practice of Gynecology," Phila., 1879) and Nathan Bozeman (" The Gradual Preparatory Treatment of the Complications of Urinary and Fecal Fistulæ in Women," *New York Jour. Med. Sciences*, October 1, 1887) developed the method of treating large and complicated fistulæ by gradual preparatory treatment, incising the bands of scar tissue, and softening them by pressure so as to make the vaginal walls supple enough to be drawn together.

In spite of the advances made by these great surgeons, a large number of intractable cases remained.

Colpocleisis, or a surgical closure of the vagina so as to make a common pouch out of the vagina and the bladder, was performed in such cases by Simon in 1855, and has been practiced more or less ever since. The great advances which have been made recently can best be signalized by citing the eight indications for colpocleisis accepted by Simon, with the remark that not one of them holds good to-day. They were:

(*a*) An extensive loss of tissue, rendering it impossible to approximate the margins of the fistula.

(*b*) Inaccesible fistula.

(*c*) Destruction of the uterine cervix, bringing the peritoneum dangerously near the seat of operation.

(*d*) Severe hemorrhage into the bladder after an operation.

(*e*) Incarceration of the cervix uteri in the bladder.

(*f*) Atresia of the vagina above the fistula.

(*g*) Atresia of the urethra, with a fistula above and below it.

(*h*) Uretero-vaginal and uretero-utero-vaginal fistula.

The first active steps taken in an entirely new direction, with the object of relieving these cases without resorting to a procedure involving so much mutilation as does colpocleisis, were those of Rydygier (*Berl. klin. Wochenschr.*, 1887, No. 31) and of A. Martin, of Berlin (*Zeit. f. Gyn. und Geb.*, 1891), who planned to cover in the defect with large flaps dissected up from the contiguous vaginal walls.

L. v. Dittel ("Abdom. Blasenscheidenfisteln Operation," *Wien. klin. Wochenschr.*, 1893, No. 25) made a radical departure from all precedent by opening the abdomen and detaching the bladder from the uterus, thus exposing the fistula, which was then sewed up; the sutures included only the bladder walls, and after closing the opening in this way, the vesico-uterine peritoneum was again united and the abdomen closed.

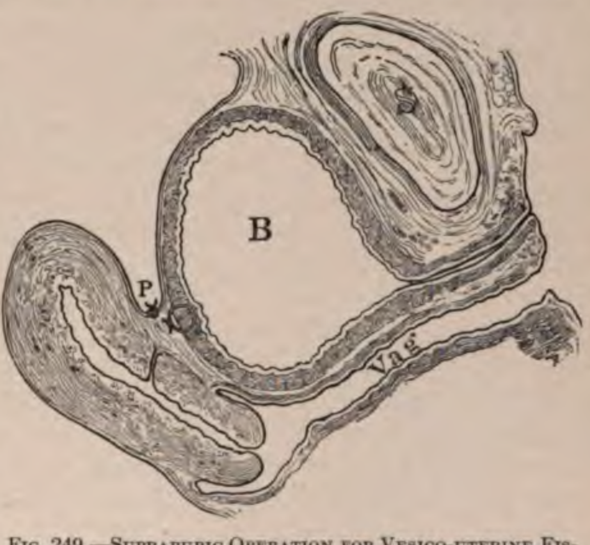


Fig. 249.—Suprapubic Operation for Vesico-uterine Fistula. (v. Dittel.)

The operation completed, the bladder and the peritoneum sutured.

A. Mackenrodt, of Berlin (*Centralb. f. Gynäkol.*, 1894, No. 8), adopted a somewhat similar plan, but one making a definite advance on the preceding, in that he operates through the vagina and detaches the bladder on all sides from the fistula; he then sews up the bladder independently and closes the opening in the vagina by drawing its sides together, if possible; if he can not do this, he uses the anterior face of the uterus to fill out the defect. With the exception of this last step, the important outlines of this operation were already defined by Sänger (*Volk. Samm. klin. Vort.*, No. 301) and Walcher (*Centralb. f. Gyn.*, 1894, p. 1).

W. A. Freund (" Eine neue Oper. z. Schliessung gewisser Harnfisteln beim Weibe," *Samm. klin. Vort.*, N. F., 1895, No. 118) again operated in a radically different direction when he used the body of the inverted uterus, bringing it into the vagina through the posterior fornix, to close a large defect in the vesico-vaginal septum.

Dr. E. C. Dudley, of Chicago, succeeded in closing a large intractable fistula by making a semicircular denudation inside the bladder on its mucous surface, extending from one margin of the fistula around to the other; he then sutured this denuded surface to the anterior part of the fistula, and so obtained a closure.

My own plan (*Johns Hopk. Hosp. Bull.*, Feb., 1896) is to split the margin of the large fistula posteriorly, separating the bladder wall from the vagina; then to denude its anterior margin on the vaginal surface, and to suture the movable posterior bladder wall to the fixed anterior vaginal wall.

Causes.—Vesico-vaginal fistulæ are commonly caused by the traumatism of a difficult labor, resulting from the impaction of the child's head in a narrow pelvis. In consequence of the prolonged pressure, the vitality of the vesico-vaginal septum is destroyed at the point at which it is compressed between the head and the symphysis pubis; in a few days a slough has formed, and the piece of tissue drops out, leaving an opening between the bladder and the vagina. I have repeatedly made pelvic measurements in these cases, and rarely found a fistula following parturition which was not in a contracted pelvis. (See Dr. G. W. Dobbin, " The Use of Pelvimetry in Gynecology," *Amer. Jour. Obst.*, August, 1895, p. 201.)

The impression which has prevailed in the profession that these fistulæ are often due to the use of the obstetric forceps is erroneous, for they are undoubtedly due not to the use of the forceps, but to too long a delay in using them. This point was insisted upon by W. T. Schmidt in 1828 (v. Siebold's *Jour. f. Geb. und Frauenz. und Kinderkrankheiten*, Bd. vii, p. 339), and in our own day by T. A. Emmet, of New York.

Other causes are foreign bodies, such as stem pessaries, working their way from the vagina into the bladder, or *vice versa* (Fig. 265, p. 439); syphilis; a cancer extending from the cervix uteri, which often destroys the anterior vaginal wall and so creates a fistula; the perforation produced by a pistol ball (Emmet); hematoma of the septum from coitus, followed by sloughing; the wounds of a vaginal hysterectomy, which are also to-day a frequent source of vesico-vaginal fistula.

The course of a fistula uninterfered with is toward closure, either by primary union, or by granulation, cicatrization, and contraction of its edges. In this way, by cicatrization, a small fistula will usually close entirely in a few weeks' time, and large ones will be reduced to one-half or one-third their original size. A clean-cut opening, such as that made for the extraction of a stone, may possibly close of itself without any suture, even if it is a large one. In time the margins of a large fistula grow sharp and hard with cicatricial tissue, and in bad cases the cicatrices radiate out over the vaginal walls, or pin the fistula down to a pubic ramus. The posterior walls of the vagina may also be involved in such a manner as to close the vagina so tightly that it is difficult to see the fistula.

Although the tendency of the smaller fistulæ is always toward a spontaneous cure, in some instances a minute opening may persist for many years. I operated, for example, upon a patient who had had a fistula for twenty-three years, and the opening was not much larger than a hair; yet it was large enough to permit the constant escape of urine into the vagina with all its disagreeable consequences.

Symptoms.—The symptoms produced by vesico-vaginal fistulæ are quite characteristic. Soon after the confinement which causes it there may be bloody urine, difficulty in urination with symptoms of cystitis, and marked febrile disturbances, followed in a week or more by the escape of a slough, after which the urine, instead of accumulating in the bladder, escapes at once through the opening into the vagina, and so out over the vulva, perineum, and adjacent parts, which are constantly kept wet. The effect of this upon the skin is to produce a painful dermatitis and excoriations, and the vulvar hairs often become incrusted with the urine salts. Areas of excoriation are also found within the vagina, often coated with sabulous material and incrustations. The parts involved may be so exquisitely tender that the slightest movement is painful, and anything like a thorough examination is often impossible without anesthesia.

If the fistula is a small one, the patient may, in certain positions, retain a considerable amount of her urine and void it naturally. If the vaginal outlet is not broken down, considerable urine may accumulate within the vagina in the recumbent posture to escape on rising; this often leads the patient into the erroneous idea that she holds the urine in the bladder while lying and passes it naturally afterwards; one of my patients was able to hold even as much as 300 c.c. of urine in this way.

The effect of a fistula on the patient's general health is often most marked; the local discomforts compel her to remain pretty constantly in one place and in one position, preventing her from getting exercise and fresh air; nutrition fails, she becomes emaciated, excessively constipated, depressed, and peevish, and has a cachectic appearance.

In spite of the obstacles rendering conception rare, it has occurred. In one of my own cases, the patient, having a fistula 1.5 cm. in diameter just back of the neck of the bladder, conceived, and passed through a natural labor and a normal puerperium, after which the fistula was operated upon and cured.

In a case in the hands of L. v. Winckel (*Handb. der Frauenkrank.*, vol. iii, p. 441) a patient with a fistula became pregnant and passed through her confinement at term, after which the fistula actually healed spontaneously.

Diagnosis.—In making a diagnosis of a vesical fistula, the examiner must investigate all the associated conditions which tend to complicate the case. In doing this he will not only note the size, the form, and the exact site of the fistula, but will also carefully investigate into the condition of the surrounding vaginal walls: whether soft and yielding or fixed by scar tissue, whether the anterior lip of the cervix is involved in the fistula (cervico-vesico-vaginal), whether the neck of the bladder is included (vesico-urethro-vaginal), and whether the fistula is fixed to one or the other pubic ramus. It is most important also to note the position of the ureteral orifices in their relation to the edges of the fistula. Other complications which may occur are the existence of two vesico-vaginal fistulæ, or of a vesico-vaginal fistula and a urethro-vaginal or a vesico-uterine fistula existing together. I have seen one case of vesico-vaginal fistula following a severe labor, complicated by a recto-vaginal fistula, and an atresia of the upper vagina with hematometra. In another case with a vesico-vaginal fistula there was also a complete rupture of the recto-vaginal septum (see F. Plater's first case in I. Spach's *Gynæc. Libri*, Argent., 1597, p. 23, index). In still another instance, in my hands, a large vesico-vaginal fistula, adhering to the pubic ramus, was associated with a wide separation of the symphysis pubis ruptured in a badly managed forceps labor.

The diagnosis of a vesical fistula is made by a consideration of the history, by touch, and by inspection.

The patient gives a history of a constant discharge of urine over her person, dating usually from a severe confinement or from a hysterectomy; if, in spite of the fact that she has this constant flow, she also passes water at regular intervals, the probable diagnosis will then be one of ureteral and not of vesical fistula.

By touch the examiner will often feel more or less scar tissue in the vagina and a large hole in the anterior vaginal wall, which may be filled with the soft prolapsing mucous membrane of the bladder; the finger can be introduced through this hole into the bladder, and carried forward so as to feel the internal orifice of the urethra.

Inspection affords the fullest information about the fistula and the associated conditions. To make a vaginal inspection the posterior vaginal wall must be drawn back and the anterior wall exposed. A large fistula is seen as soon as the accumulated urine is dried out of the vagina; to find a smaller one it may be necessary to hunt among the vaginal folds, when it will often be found near the vault and to one side or the other of the cervix. A vesico-uterine fistula gives evidence of its presence by the urine which escapes from the cervix uteri.

When the fistula can not be found in this way it will usually be detected by injecting the bladder with an aniline solution, or with sterilized milk, and then watching to see at what point the colored fluid runs out. If a fine sound is carried into the bladder through the urethra, its end can usually be brought out through the smallest fistula.

The cystoscope may also be used to examine the fistula from the vesical side, but this is not so easy as the vaginal examination, because the floor of the bladder lies almost in the plane of vision, and the hole in it with its inverted mucous membrane is seen so foreshortened that it may easily escape notice altogether. It is therefore necessary, in order to get a good view of it, to lift the floor up on the end of the speculum, so as to bring the opening across the plane of vision.

Treatment.—In describing the various modes of treatment, I shall consider vesical fistulæ under the following heads:

1. Vesico-vaginal fistula.
2. Vesico-utero-vaginal fistula.
3. Vesico-uterine fistula.
4. Entero-vesical fistula.

At the time when the injury to which the fistula owes its origin occurs, the physician is not, as a rule, aware of the nature of the accident, nor does he become so until the slough comes away; then the constant involuntary escape of the urine signalizes what has happened. It may be, however, that the urine will begin to escape some days before the sloughing is complete, when the examining finger detects a soft, crackling mass in front of the cervix; it is important at this time to begin at once the use of mildly antiseptic vaginal douches several times daily, to prevent the accumulation of fetid discharges in the vagina, and to keep the wound as clean as possible. The convalescence will be hastened if the slough is exposed, caught with forceps and the dead tissue cut away; small particles which still adhere to the edges of the wound will then soon detach themselves and leave a clean, granulating surface.

Mild boric acid or mild carbolic acid douches should now be kept up until the fistula is healed, either spontaneously or by operation. A spontaneous cure may reasonably be expected only in the case of small fistulæ 1 or 2 cm. in diameter and may be awaited as long as the wound shows signs of contracting; such a closure may take place in from two to four months, and in exceptional cases after six or eight months.

The efforts made by our predecessors to bring about a cure by simple posture, or by putting a catheter in the bladder through the urethra, or by placing pledgets of cotton in the vagina, can not be recommended with any assurance of their utility; such measures belong rather to the days when local treatment in gynecology was the only resource.

Cauterization was at one time extensively employed, and many cures were made in the case of smaller fistulæ. The edges of the sound were treated with the nitrate of silver stick, Vienna paste, caustic potash, tincture of cantharides, or the hot iron, and later with the Paquelin cautery.

The cautery is applied to the edges of the fistula on the vaginal surface so as to destroy the superficial tissue and provoke active granulations, which, meeting across the opening and uniting, close it at once; or in the case of a large opening, further cicatricial contraction is brought about. It is, as a rule, necessary to keep this treatment up at intervals of a week or ten days for two or three months. Such plans of treatment have to-day almost entirely passed out of vogue, and will only be resorted to in the early stages of the affection when it is too soon to operate, or when for some other reason the operation can not be performed.

It is a significant fact that the best results by this plan of treatment have been reached during the early stages of the disease, at a time when the spontaneous cure takes place, if it is going to take place at all.

Operation.—The operative treatment is, as a rule, the only form of treatment to be considered, for in the simpler cases it is invariably successful, and in the more complicated cases nothing short of operation will bring relief.

Preparatory treatment is necessary in most cases where the vagina contains sloughing necrotic tissue and incrusted urine salts, and where the contiguous parts are raw and granulating; these complications will be removed by prolonged, repeated, warm boric acid vaginal douches, a repeated painstaking cleansing of vagina and vulva, using forceps and cotton to remove and wipe off sloughs and *débris,* followed by occasional applications of weak solutions of the nitrate of silver to the raw surfaces. At the same time bands of scar tissue may be incised so as to diminish the tension on the wound edges.

If a recto-vaginal fistula also exists, in order to avoid infection of the wound, this must either be closed and healed before operating upon the vesico-vaginal fistula, or both must be closed at the same time. It will be safer in most cases to close the rectal opening first, because there is always a greater risk of this breaking down, in which case the vesical wound would almost certainly be infected and give way also.

The operator need not be embarrassed by finding a marked stenosis of the vaginal orifice at the time of operation, for this may be, at once, extensively divided with the knife by an incision down beside the rectum, giving all the room necessary to get at the fistula; and after the vesical operation is completed the incised edges may be accurately united again.

With more recent advances made in operating on bad fistulæ, we are able to dispense with some of the elaborate, time-consuming, preparatory treatment in the way of incisions and vaginal dilators used to get rid of the scar tissue.

The best time to operate is within six or eight weeks after labor, while the tissues are soft and yielding, vascular, and free from the fixation and the atrophy caused by scar tissue. If the fistula is a small one and its edges can be easily drawn together with tenacula, with a little freshening of its margins and several sutures to unite them, primary union is easily secured; large and irregular fistulæ are far more difficult to unite. The operation becomes most difficult after the formation of the scar tissue, distorting and fixing the edges. Even pregnancy forms no contra-indication to operation, as shown by the successful work of Schlesinger and others.

Instruments needed for the operation are: Speculum, lateral retractors, tissue forceps, fistula knife, fistula scissors, tenaculum, needles, silkworm gut, catgut, and silk.

There are, in general, as briefly indicated above, seven different ways of closing vesico-vaginal fistulæ:

1. The classical method of denuding the margins on the vaginal surface and uniting them by suture (Van Roonhuysen, Jobert, Sims, Simon).
2. Covering in the defect by flaps transplanted from the contiguous vaginal walls (Rydygier, Martin, Trendelenburg).
3. Opening the abdomen and cutting through the vesico-uterine peritoneum, and so detaching the bladder from the fistula, sewing up the bladder wound, and then reuniting the peritoneum and closing the abdomen (v. Dittel).
4. Denudation on the vesical mucosa from one side of the fistula around to the other, and uniting this surface to the freshened anterior part of the fistula (Dudley).
5. Dissecting the bladder loose from the vagina and sewing up the vesical wound separately (Sänger, Walcher, v. Winckel). The anterior face of the uterus is used to close the vaginal defect (Mackenrodt).
6. Freeing the bladder around the posterior two-thirds of the fistula, bringing it forward and uniting it to the anterior third, which is freshened on its vaginal surface (Kelly).
7. The posterior fornix is opened and the body of the uterus brought through it inverted and attached to the edges of the fistula on all sides, so closing it (Freund).

Curing a Vesico-vaginal Fistula by Denudation of its Margins and Approximation of its Edges by Suture.—This is the simplest mode of treatment, and is adapted to all fistulæ in which the edges can be drawn together without much tension; if this can be done with tenacula beforehand, the operator may feel reasonably sure of a successful result. The easiest fistulæ to close in this way are all the small ones, and the larger ones which are situated in the upper part of the vagina near the cervix, where the vaginal tissue is more lax and abundant; and the easiest large fistulæ are the transverse ones.

When the edges can not be brought easily together by traction with the tenacula in any direction, the denudation and approximation by suture may still be tried, if the operator has had such experience in plastic work that he is able to form a good judgment as to the extent to which he will be able to relieve the tension by lateral incisions through the scar tissue, which fixes the edges of the wound. It is worse than useless to denude the edges of a large fistula without having any definite idea as to what can be accomplished until the stitches are put in and pulled upon. It would be far better to let the patient entirely alone, and to confess honestly an inability to relieve her, than to go on cutting away valuable tissues and increasing the size of the fistula every time, with a vague idea that by some chance the operation will succeed. I have seen several women who had been operated upon as many as five and six times in this way, and were in no wise better, but far worse for it.

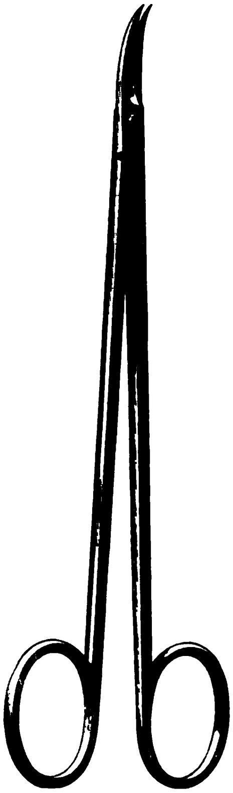


FIG. 250.—SCISSORS FOR PARING THE EDGES OF THE VESICO-VAGINAL FISTULA.

The shanks are made long and slender and the blades are delicate and curved on the flat. ⅔ ordinary size.

The patient is put on the table, in the left lateral or in the lithotomy position, or with elevated hips, after Simon, in whichever way the fistula can be exposed best; I prefer, myself, in almost all cases, to put the patient on her back.

The posterior vaginal wall is drawn strongly backward, and lateral retractors are used on one or both sides, to give a perfect exposure to the field of operation.

The steps of the operation are: (1) Paring the edges of the fistula; (2) passing and tying the sutures.

The edges of the fistula should be pared on the vaginal surface entirely; this creates a freshened area from 5 to 6 or 8 mm. in breadth, extending down to but not including the mucous membrane of the bladder.

Either a knife or scissors may be used to remove the tissue; a knife is necessary where there is much friable tissue, but in most cases I prefer a delicate pair of scissors, which I have had made for this purpose (see Fig. 250), and I denude in the following manner:

With a knife I first outline the limit of the denudation all around the fistula, and when this is done I take the rat-toothed forceps, catch a piece of the tissue to be removed, and begin cutting it off with the scissors. This can be done rapidly, as the outer limit is marked out by the incision with the knife, and the operator does not have to pause to exercise his judgment about it; in addition to this, the sharp, straight cut of the knife is better than the jagged edges made by the scissors.

The freshening must be carried down into sound tissue, avoiding the error of simply paring off the surface. Every particle of the tissue within the limits defined must be removed, or union will not take place; and to make sure that this has been done, little islets of undenuded tissue must be carefully sought out and picked up with a tenaculum and snipped off.

Constant irrigation with a fine stream of water is the best way to keep the field clear of blood during the cutting, but a little piece of sponge grasped in a pair of forceps will often be needed to make firm pressure on some spot which is obscured by the free oozing; this blanches the tissue for a second or two, and as the bleeding begins again the operator can see whether there are any little undenuded areas which do not bleed. The entire wound now has a fresh edge gently beveled on to the vaginal surface.

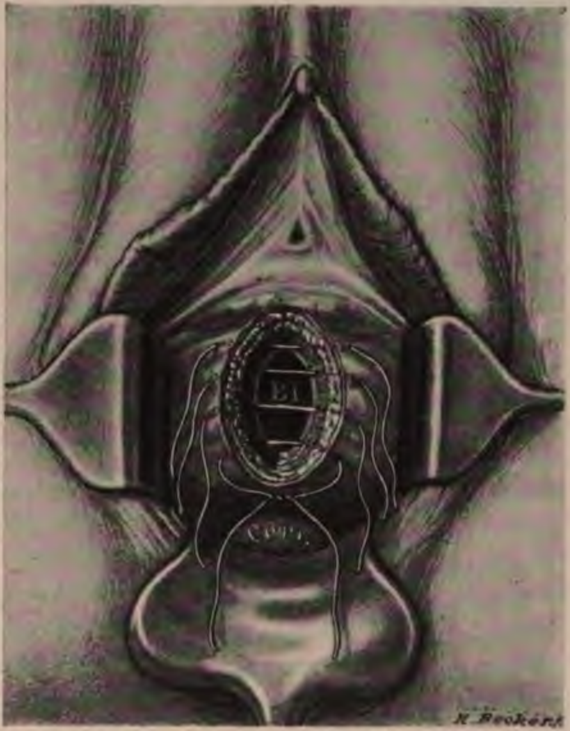


FIG. 251.—CLASSICAL OPERATION, SUTURES INSERTED TRANSVERSELY INSTEAD OF VERTICALLY.

Passing and tying the sutures is the next step. To do this I use the ordinary needle-holder and small curved needles armed with a carrier made of fine silk.

A tenaculum is often needed to steady the tissues while passing the needle through them, and to catch and hold the point of the needle as soon as it emerges, until it can be grasped by the needle-holder again and drawn completely through.

By simply following the direction of least resistance in passing the sutures during a variety of cases, the resulting wound will assume the form of a **U**, **V**, **∼**, **–**, **I**, or \. When possible it is best to avoid bringing three points together, as in an **H** a **Y** or a **X**.

As a suture material I prefer to use a fine, flexible silkworm gut, often using catgut between the other sutures. Before passing the first silkworm gut suture, the operator must determine in which direction the edges of the wound will come together with the least traction; he then passes the suture which is to lie in the middle of the wound when it is closed. To do this the needle must pierce the vaginal mucosa about 3 mm. from its edge, and appear just under the mucous membrane of the bladder; it then enters the opposite side at the border of the freshened surface and the bladder mucosa, and finally emerges on the vaginal surface 3 mm. away from the edge of the wound, corresponding to the point of entrance.

Other sutures are similarly introduced on both sides of this first one, about half a centimeter apart, until there are enough sutures laid to close the wound from side to side. Especial care must be taken to secure an accurate apposition of the wound at its angle. The suture first introduced is then tied, and after that those at the sides. The amount of tension made in tying them must be just enough to bring the tissues snugly together; constriction of the tissues within the grasp of the suture loop must be avoided. As a rule there is a little pouting between each of these silkworm gut sutures, and this is best corrected, after tying them, by passing a sufficient number of fine catgut or even fine silk sutures with a small needle penetrating only about halfway through the septum.

If the fistula lies near the neck of the bladder, the operator can not be too careful to avoid including one or both ureteral orifices in his sutures. This has often been done, and the patient has as a consequence either lost her life, or the intense renal colic brought on has compelled the operator to remove his sutures soon after the operation. This accident will only be avoided by (1) examining the edges of the opening beforehand and making sure that the little ureteral orifices are not situated there, and (2) by taking care not to pass the sutures so deeply that a ureter which opens somewhere near the wound will be caught in its loop.

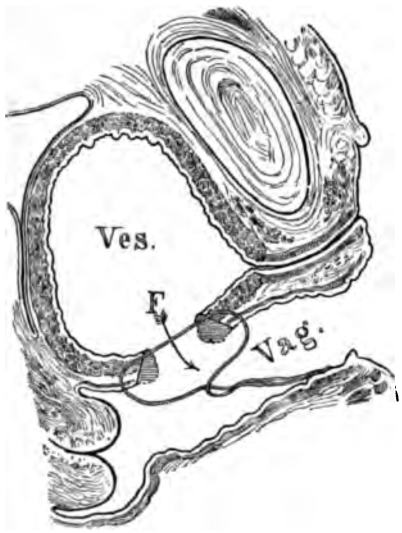


FIG. 252.—CLASSICAL OPERATION FOR VESICO-VAGINAL FISTULA.

The parallel lines show the tissue removed in denuding the edges of the fistula, and the suture is placed ready to tie. The entire thickness of the vesico-vaginal wall, excepting the bladder mucosa, is included in the suture.

If the ureteral orifice is found in the margin of the fistula it must be put out of harm's way either by introducing a catheter into it, dissecting it up for a short distance, turning it into the bladder, and then completing the denudation and suture of the fistula; or else by denuding farther out onto the vagina, and so securing a wide enough surface for the closure of the fistula, without coming into contact with the ureteral orifice. This has the effect of turning the ureter up into the bladder without disturbing it.

Where the fistula is pinned down at one of its angles to one of the pubic bones, a plan which I adopted in one of my cases may sometimes be put into successful practice. I introduced a long delicate tenotomy knife on the vulvar surface about 3 cm. from the fixed point, and carrying it under the mucous membrane as far as the fixed point, cut it loose from the bone without puncture. The hemorrhage was but slight. I was then able to bring the tissues together without undue traction, and a perfect union resulted.

Aside from the danger of including a ureteral orifice in a suture, there is one other risk connected with the operation, and that is hemorrhage into the bladder from the edges of the incision. This occurred in a case operated upon by one of my assistants, when the wound had to be reopened five hours after the operation, and 700 c.c. of blood clots were removed. The stitches were put in again, this time including the mucosa, and the patient then recovered with perfect union. In a case operated upon by J. Bäcker (*Centralb. f. Gynäkol.*, 1893, No. 38) the bladder became distended with blood almost to the navel and ruptured into the peritoneal cavity under violent straining efforts; the patient died forty-five hours after the operation, of acute sepsis.

After-Treatment.—The care of the patient after the operation consists in keeping the bladder empty for five or six days and requiring her to remain in bed. It is a good practice to put a soft gauze pack in the vagina to give gentle support to its walls; a soft rubber catheter is put in the bladder and retained there for from four to seven days, according to the size of the fistula. I find it tends to relieve the irritation which this often produces to take it out for an hour every morning and evening. The vaginal pack should be replaced when it becomes soiled.

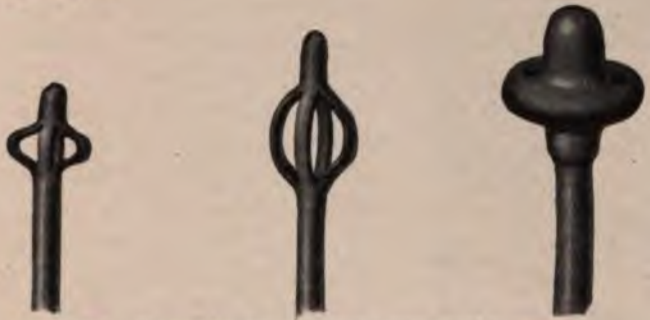


FIG. 253.—THREE STYLES OF SELF-RETAINING CATHETERS.

The one generally used is seen on the right. The holes can be enlarged for irrigations and more rapid drainage. The entire length of the catheters is about 25 cm.

An ordinary rubber catheter may be held in place by a stitch through one of the labia minora at the nearest point. The Pezzer and Malecot catheters shown in the figure have come into extensive use, and have proved most satisfactory for the purpose of permanent drainage of the bladder. I often find it best to enlarge the openings in the Malecot catheter or to make one or two additional openings. As is evident from their form, these instruments are self-retaining. They are introduced with a probe or a uterine sound passed through one of the openings and used to push the end of the catheter until it is straight, when it is easily passed into the bladder with a little lubricant. Upon withdrawing the sound, the catheter resumes its expanded form and is self-retaining. It is a distinct advantage of these catheters that they do not penetrate far into the bladder, but lie at the neck (see Fig. 253).

In small fistulæ, or larger ones where the approximation has been easily made, I often do not leave a catheter in at all, but order the patient to empty the bladder herself or have it emptied every three or four hours for four days, when the interval may be lengthened.

The bowels should be opened on the third day by giving a purgative followed by an enema.

The silkworm gut stitches may be removed in twelve or fifteen days.

The ability to retain the urine always increases as the bladder grows accustomed to the resumption of its normal function.

In addition to the classical method of closing an ordinary vesico-vaginal fistula which I have just described, two other essentially different plans have been successfully carried out by F. Vulliet and A. F. McGill.

Vulliet's procedure (*Nouv. arch. d'obst. et de gyn.*, 1887, p. 512) consists briefly in the union of the tissues denuded on the vaginal surface by two layers of sutures, one buried and one superficial.

The patient had had a fistula for seven years, and had already been operated upon three times, with the effect of filling in the deficiency, about 2 cm. in diameter, with a thin layer of scar tissue perforated in three places like a sieve. This tissue, not available for plastic purposes, was sacrificed, and a denudation 8 mm. in diameter made around its border in the sound tissue. The anterior and posterior extremities of the fistula were then caught with forceps and pulled in opposite directions until the edges came into contact. The first suture was then introduced, threaded directly in a small needle. The suture, made of silk and permeated with iodol and glycerin, was passed continuously along the margin of the fistula, entering and re-entering at points close together. By this means alone the closure was so effective that no more fluid escaped from the bladder in spite of the coughing and straining under anesthesia. Another layer of sutures was then applied below this one, completely closing the wound. Seven days later the superficial sutures were taken out, and the union found perfect.

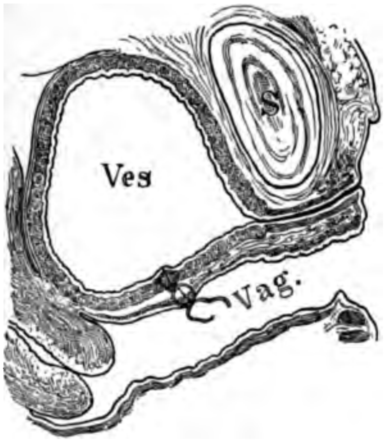


FIG. 254. — VESICO-VAGINAL FISTULA CLOSED BY USING A BURIED SUTURE OF CATGUT IN THE BLADDER WALL AND THEN UNITING THE VAGINA OVER THIS.

An interesting method is that of A. F. McGill, of Leeds (*Lancet*, November 8, 1890, p. 967), entitled "An Operation for Vesico-vaginal Fistula through a Suprapubic Opening in the Bladder." The patient, seventeen years old, had an opening in the vesico-vaginal septum just in front of the os uteri large enough to admit the tip of the index finger.

The operation was performed January 11, 1890. The pelvis was elevated and the bladder opened above the symphysis by a transverse incision, and fixed to the abdominal wall.

The fistula was then pushed up within reach by an assistant with two fingers in the vagina, its edges freshened, and then completely closed by four chromicised catgut sutures passing through the vesical mucosa only.

The patient was then placed in the lithotomy position, and the wound closed on the vaginal surface with four silk sutures, including all the layers but the vesical mucosa.

The suprapubic wound was now closed in three layers—bladder, abdominal muscles, and skin—leaving an opening for a drainage tube, which was removed on the fifth day. On the eighth day she passed urine by the urethra, in less than a month the suprapubic wound closed, and on February 13th she returned home well.

A method recommended by Sänger and v. Walcher involves the separate suture of the mucosa after freeing it from the margin of the fistula. The catgut which unites the mucosa is then buried by a separate layer closing the vaginal opening (see Fig. 254).

Various Forms of Fistulæ.

Vesico-vaginal Fistulæ of Large Size.—The type of a simple fistula of small or medium size, in which the edges can be brought together after denudation without undue traction, has just been described. When, however, the defect in the floor of the bladder is large, and there is a great deal of scar tissue in the vaginal walls, it may be difficult, or even impossible, to draw the edges together. Even when the operator succeeds in doing this the sutures are sure to cut through before union has taken place. Among these cases must also be placed a little group in which a fistula of medium size is converted into a large one by the successive parings of unsuccessful operations.

Cases classified under this group have, in the past, either been cured only after months of preparations and repeated operations, or they have been abandoned as incurable, and colpocleisis has been done as a last resort.

Within the past few years a number of operative procedures have been devised which now enable us to cope with even this, hitherto hopeless, class.

I will now describe some of these various methods in detail, noting particularly that the most important point is the fact that we are able to detach the flexible bladder from the rigid vaginal wall, and to draw it together and sew it up independently.

Closure of a Fistula by Turning up Vaginal Flaps to Form the Base of the Bladder.—One of the first efforts in a new direction in the treatment of fistulæ was that of A. Martin, of Berlin (*Zeitschr. f. Geb. und Gyn.*, No. 19, p. 394), in the case of a large fistula of fifteen years' standing, comprising the entire vesico-vaginal septum, and already operated upon twice unsuccessfully.

In order to get the tissue to form a new base for the bladder, incisions were made through the vaginal wall, at some distance from the fistula and parallel to its edges. The vaginal tissue thus outlined was then loosened up in the direction of the fistula, and the edges of the flaps made in this way were drawn together and sewed as in a cleft palate operation; by doing this, that part of the vaginal mucosa which lay between the incision and the edge of the fistula was turned upward, so as to form a new floor for the bladder, leaving the raw surface exposed on the anterior vaginal wall. This raw surface was then closed in by using a continuous suture to draw it together as in an anterior colporrhaphy.

The wound healed, in spite of a catarrh of the bladder, down to an opening at the cervix.

This method is analogous to Volkmann's operation for ectopia of the bladder, in which the skin surface of the abdomen is turned inward to form the upper wall of the bladder.

Somewhat analogous to this is the plan of F. Trendelenburg (*Samm. klin. Vort.*, 355, 1890), who closed a fistula as big as the end of the index finger, already operated on seven times, by transplanting a flap from the posterior vaginal wall.

The lower and lateral borders of the fistula were freshened, and then, at a corresponding point on the posterior vaginal wall, a horseshoe-shaped flap was detached on three sides and sutured to the edges of the fistula. Four weeks later the pedicle was cut through and sutured to the freshly denuded upper edge of the fistula. As the former operations had failed on account of the occurrence of cystitis, a suprapubic opening was made for drainage of the bladder. The case made a complete recovery.

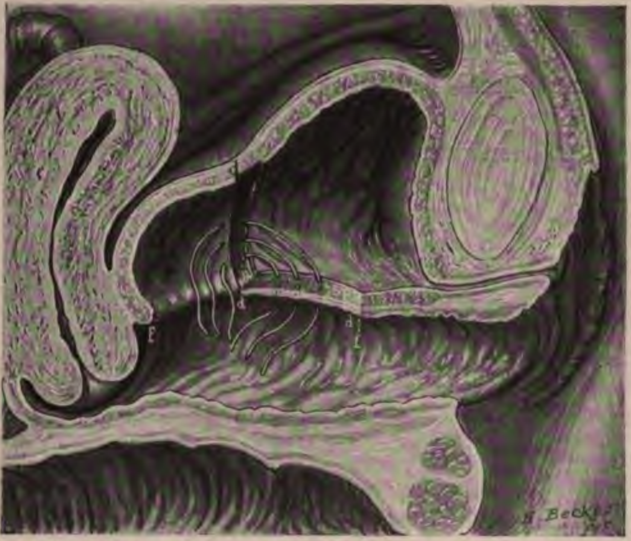


FIG. 255.—DUDLEY'S OPERATION FOR LARGE VESICO-VAGINAL FISTULA WITH RIGID MARGINS.

The diagram shows the left half of the bladder. The denudation includes the anterior part of the fistula *f f* from *d* to *d f*, and then extends up over the vesical mucosa as shown. Three of the sutures are represented in place, but not tied.

Closure of a Fistula by Suturing the Denuded Vesical Mucosa to its Anterior Margin.—This plan was carried out by Dr. E. C. Dudley, of Chicago (*Chicago Med. Journ. and Examiner*, May, 1886). In the case operated upon, the entire vesico-vaginal septum and the vaginal portion of the cervix with its anterior wall had sloughed away, and the tissues could not possibly be drawn together in the usual manner.

The mucous membrane of the bladder, however, when caught with a tenaculum, could be drawn forward to the neck of the bladder at the extreme anterior margin of the fistula without undue traction. The operator began, therefore, to close the fistula by denuding a strip on the mucous surface of the bladder from side to side, about an inch above the posterior edge of the opening. The anterior margin of the fistula was then denuded on its vaginal surface, and the denuded vesical mucosa drawn forward and attached to it on all sides by twenty-two silkworm gut sutures.

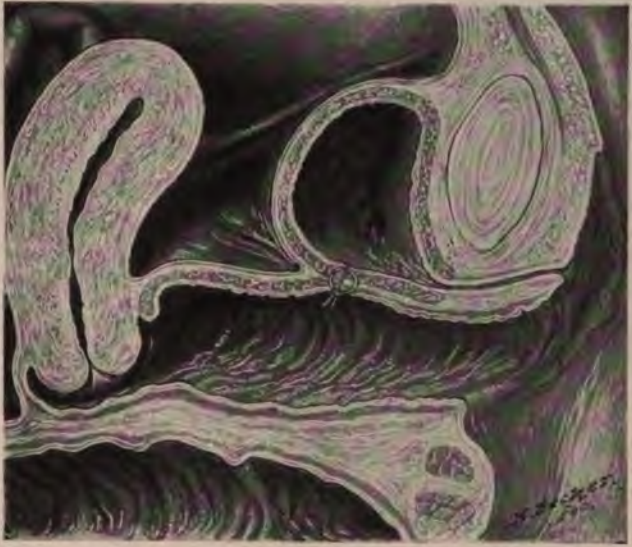


FIG. 256.—DUDLEY'S OPERATION COMPLETED, SHOWING THE NEW, SMALLER BLADDER.

The anterior vaginal wall lying between the cervix and the suture consists now of the bladder mucosa thrown out of use by the operation.

By this remarkable procedure the vesico-vaginal septum was replaced by that portion of the bladder wall which lay posterior to the line of denudation, and the new bladder formed was in this way just so much smaller. The operation was successful and the patient was able to retain her urine all night.

Closure of the Vesico-vaginal Fistula by Detaching the Bladder from the Vagina and Suturing it Independently (Figs. 259, 260.—A. Mackenrodt, of Berlin (*Centralblatt f. Gyn.*, No. 8, 1894), made a remarkable step in advance when he devised the following plan:

a. The fistula is exposed, and the cervix at one end and the urethral prominence at the other, each caught with a pair of tenaculum forceps, and the tissues between made tense by traction in opposite directions.

b. An incision is next made in the median line extending across the fistula, through the vaginal walls, and down to the bladder, so as to expose the entire base of the bladder.

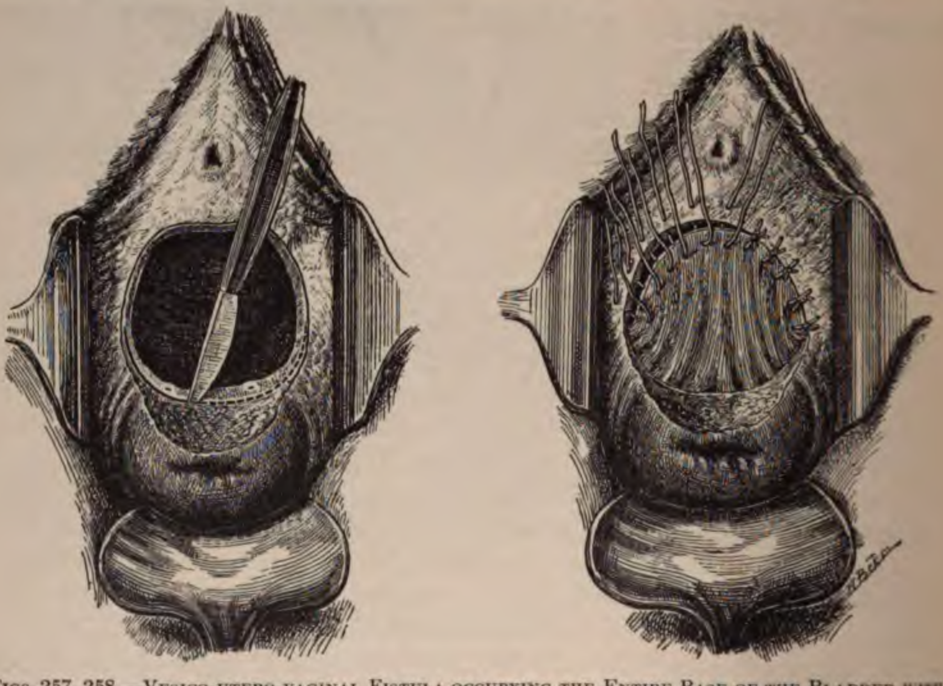
c. The edges of the fistula are then split so as to separate the bladder from the vagina, and the separation is carried out widely on all sides, extending upward, if need be, as far as the vesico-uterine peritoneum.

d. The movable elastic bladder is now closed by denuding its edges and drawing them together by fine silkworm-gut sutures. Beneath these a second and even a third row of sutures may be placed.

e. After closing the bladder in this way the vaginal wound is approximated as far as the tissues will permit by denuding its borders, drawing the corpus uteri forward, and passing sutures from side to side so as to bring the margins together and at the same time hold the uterus in anteflexion. If the vagina will not come together the uterus is used to fill in the gap, making a firm base in place of the fistulous opening.

Closure of the Fistula by Detaching the Bladder Posteriorly and Suturing it to the Denuded Vaginal Wall Anteriorly.—My own plan (*Johns Hopkins Hospital Bulletin,* February, 1896) for the treatment of large fistulæ, inoperable by the classical method, is one which was carried out in a case already operated upon five times, with the consequent loss of the entire base of the bladder, including the internal orifice of the urethra and the anterior lip of the cervix.

The patient (M. Y., 3811, Sept. 25, 1895) was forty years old and had had five children; the fistula dated from the third labor eight years before, and each one of the five efforts made to close it had only served to increase the defect without uniting any part of the tissue.



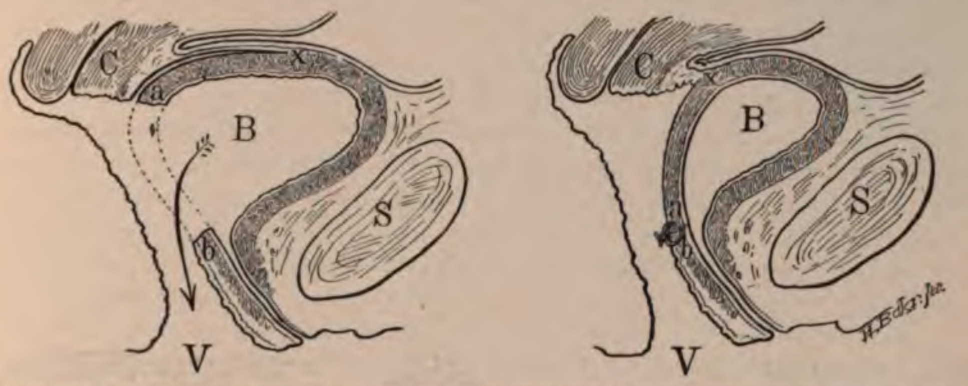
FIGS. 257, 258.—VESICO-UTERO-VAGINAL FISTULA OCCUPYING THE ENTIRE BASE OF THE BLADDER WITH DENSE CICATRICIAL EDGES AND WITH THE URETERAL OPENINGS IN THE UPPER MARGIN.

The bladder was dissected loose from the uterus and from the lateral vaginal walls around the upper half of the fistula. The lower half of the fistula was then denuded on its vaginal surface and the raw surface of the loosened bladder united to the vaginal denudation.

The opening was 4 by 3 cm. in size; the ureteral orifices were seen on its posterior border after replacing the congested bladder, which was inverted through it into the vagina; the edges of the fistula were fixed by scar tissue and by scars radiating out over the vaginal walls.

The steps of the operation were the following:

a. A crescentic incision was made around the posterior two-thirds of the fistula, separating by a blunt dissection the bladder with its muscular and mucous coats from the vagina and the cervix laterally, and all the way up to the peritoneum.



FIGS. 259, 260.—VESICO-UTERO-VAGINAL FISTULA, SHOWING THE WAY IN WHICH THE BLADDER WAS DETACHED FROM THE UTERUS ABOVE FROM *a* TO *x* AND BROUGHT DOWN AND ATTACHED TO THE DENUDED VAGINA AT *b*.

b. The remaining anterior third of the fistula was then pared on its vaginal surface, extending the denudation down to but not including the vesical and urethral mucosæ.

c. The ureters were marked out and protected during the next step by passing two flexible ureteral catheters 2¼ mm. in diameter through the urethra, one into each ureter.

d. The detached part of the bladder behind was now easily drawn forward and accurately united by interrupted fine silkworm gut sutures to the immovable anterior third of the fistula on its vaginal surface; each suture caught the under surface of the muscular wall of the bladder so as to turn its edge up into the newly formed bladder. The ureteral orifices were in this way directed upward, and they escaped compression and transfixion through the presence of the catheters. The vaginal opening was not closed.

I left the ureteral catheters in place three days to drain each kidney through the urethra and put the bladder entirely at rest, thus avoiding any strain on the healing tissues.

The wound healed throughout, except at the left upper angle, where a fistulous sinus 1 mm. in diameter was left; through this a little urine escaped occasionally. On leaving the ward the patient could hold 100 c.c., and did not have to empty the bladder oftener than once in three hours. The raw surface on the anterior vaginal wall was replaced by a firm contracting cicatrix.

Closure of an Extensive Vesico-vaginal Fistula by Suturing the Body of the Uterus into the Defect.—This operation was devised and practiced with success in two cases by W. A. Freund (*Samm. klin. Vort.*, No. 118, 1895). The first patient was forty years old, and had lost the posterior wall of the urethra and a considerable part of the sphincter area at the neck of the bladder. The opening into the bladder easily admitted the index finger; the tissues around the fistula were bound to the pelvic bone by extensive radiating scars, and the cervix was hidden in a mass of scar tissue at the vault of the vagina.

Douglas' pouch was opened, the retroflexed uterus drawn out into the vagina and scraped on both sides in front of the broad ligaments until it bled, after which it was sutured to the freshened edges of the opening in the bladder and the posterior half of the urethra. The fundus uteri was then removed so as to expose its cavity, and the edges of the wedge-shaped excision were united, providing an exit for the menstrual discharges. After a protracted convalescence, marked by attacks of fever, the discharge of sutures, and a varying degree of continence, the patient was able to retain the urine, so that five months later she only passed it twice in three and a quarter hours, and could void it voluntarily as soon as there was any accumulation in the bladder.

Four months after the first operation the defect of the anterior part of the urethra was made up by drawing over it the contiguous vaginal walls and suturing them together. Menstruation took place from the new cervix formed at the open fundus.

The second case was that of a young woman, twenty years old, in whom the entire base of the bladder had been lost. The perineum was torn back into the lax sphincter, and there was a recto-vaginal fistula high up. The urethral orifice formed a slit opening into a urethra 1½ cm. long. The edges of the fistula were surrounded with extensive scar tissue, and the cervix was concealed in a mass of scars at the vault.

At the operation Douglas' *cul-de-sac* was opened; then the recto-vaginal septum was split, from the incision in the vaginal vault down through the recto-vaginal fistula and on downward through the anus. The edges of the large defect in the anterior vaginal wall were now encircled by a broad area of denudation, and the retroverted uterus drawn out through Douglas' pouch and freshened by scraping its borders in front of the broad ligaments. The uterus was then attached to the edges of the fistula on all sides by silk sutures, which had been previously laid through the margins of the fistula.

The scar tissue and edges of the fistula in the recto-vaginal septum were now removed and closed on the rectal side with catgut, and on the vaginal side with silk sutures. The body of the uterus was next united to the urethra, and the fundus uteri removed in a wedge-shaped excision and sutured on all sides. Finally the perineal wound was closed with wire sutures uniting the sphincter and about 1 cm. of the tissue above it. The bladder was drained with a catheter and the wound healed throughout, except for the formation of a small recto-vaginal fistula, which closed spontaneously after the escape of some silk threads.

Three months after the operation there was no incontinence of urine, and the weak sphincter had recovered its power under the use of hypodermics of strychnin in its immediate neighborhood. All lateral expansion of the bladder had disappeared, and instead of this there was a distention of 18 cm. upward.

Vesico-utero-vaginal Fistula (Fistula Laqueatica).—These fistulæ are situated at the vault of the vagina close against the cervix, which is frequently involved by the destruction of a portion or all of its anterior lip.

They occur either from extensive sloughing in this region, or, more frequently, from a laceration of this part of the cervix, often due to the obstetric forceps, extending into the vault of the vagina and on into the bladder. This mode of origin is well shown in a case reported by Dr. H. C. Coe (*Amer. Jour. Med. Sci.*, 1890, p. 487), in which he did a successful suprapubic amputation of the uterus for rupture during labor. Before Dr. Coe operated on the woman, however, an attempt had been made to introduce the forceps through the undilated cervix, which resulted in a rupture of the cervix extending into the bladder and leaving a cervico-vaginal fistula behind.

A similar case of double fistula is also figured by Otto v. Herff (*Zeit. f. Geb. und Gyn.*, vol. xxii, 1891, p. 10).

A case of my own, which I saw April 1, 1885, also goes to prove that these fistulæ are often the result of a tear rather than a sloughing. The patient had had a severe instrumental labor with a stillbirth six weeks before; she came to me with a small fistula just at the vault of the vagina on the right side against the cervix. This fistula opened two ways, from the bladder backward into the cervical canal, and downward into the vaginal vault. (See Fig. 262.) There is, I think, no conceivable way in which such fistulæ, lying so close together in this position, could have been brought about, except by a tear extending through the cervix and forward into the bladder, followed by a healing of the vaginal cervix between.

The fistula following a tear is apt to be small, while that following a slough may take in the whole anterior part of the vaginal vault.

Treatment.—A small fistula of recent origin may get well spontaneously, or, as in my own case just cited, may recover after stimulating applications; I used the nitrate of silver stick several times with improvement, and after the patient went home she recovered entirely.

The essential difference between the treatment of these and the vesico-vaginal fistulæ lies in the close proximity of the rigid cervix whose tissues can not be drawn together like those in the flexible vaginal walls. In addition to this, the fistula may form a sinus longer than the ordinary vesico-vaginal fistula, and the denudation and approximation may effect only the closure of the bottom of this sinus, which for this reason refuses to heal.

A variety of operations have been proposed, among which the following are of practical value:

A simple closure may be effected, in the absence of any scar tissue surrounding a small fistula, by making a deep funnel-shaped denudation on the vaginal surface, and then passing several silkworm gut sutures from before backward through both edges of the fistula and the anterior cervical lip as well. This will not succeed if there is much destruction of the cervix with scar tissue.

The anterior lip of the cervix may be effectively utilized to close a larger defect in the vault by paring its edges and attaching them by sutures directly to the sides and edges of the fistula pared on its vaginal surface. If there is too much tension created in pulling the cervical lip down and attaching it to the fistula in this way, this may be relieved by splitting the cervix bilaterally up to or above the vaginal vault, in this way elongating the anterior lip, which is then easily pulled out so as to cover in the defect.

The posterior lip of the cervix is in some cases easier to approximate to the anterior edge of the fistula than the anterior lip. When this is denuded and attached so as to fill in the defect, the cervical canal is turned into the bladder, and menstruation henceforth takes place through this viscus.

Dr. N. Bozeman has advocated the preparation of those cases where there is scar tissue and fixation by catching the uterus with forceps and dragging it down daily for some weeks beforehand, so as to gradually overcome the resistance.

Detaching the Uterus from the Bladder and then Suturing the Fistula.—The best plan of all, and one doing away with the difficult dealing with the scar tissue, is the following (see A. Wölfler in v. Herff's paper, *Zeit. f. Geb. und Gyn.*, 1891, p. 5):

a. The cervix is caught, drawn downward, and backward, and separated from the vaginal vault in front. This separation is continued well above the fistula by detaching a part of the bladder from the supra-vaginal cervix.

b. The edges of the fistula are then pared down to the vesical mucosa, taking care to get rid of all scar tissue.

c. The fistula may then be closed by interrupted fine silkworm gut sutures, or by buried continuous catgut sutures in two or three layers.

d. After this the cervix may be attached again to the vaginal vault by means of several silkworm gut sutures.

It is important, for five or six days after the operation, to keep the bladder empty, and to avoid an infection at the vault by keeping a clean, loose iodoform pack in the vagina.

Trendelenburg (*Volkmann's Samm. klin. Vort.*, 355) recommends the following plan of dealing with vesico-vaginal fistulæ when they can not be satisfactorily exposed on the vaginal side; also for fistulæ in the immediate neighborhood of the ureter, for vesico-uterine, uretero-cervical, and uretero-vaginal fistulæ:

The patient is placed on the table with the pelvis well elevated at an axis of not less than forty-five degrees to the horizontal; by this posture, when the bladder is incised, it at once fills with air, and its entire interior is well exposed to view.

The bladder is opened by making a transverse incision 10 cm. long across the upper border of the symphysis, separating the attachments of both recti muscles, and exposing the prevesical space; a transverse opening in the bladder is then made 5 to 6 cm. long. The edges of the fistula now exposed are denuded in the form of a shallow funnel in such a way as to remove a broad band of tissue from the bladder mucosa, and a narrow one from the vagina and cervix. The edges are brought together with silkworm gut sutures; in the first cases these were tied in the bladder, but later two needles were threaded on one suture, and both ends were passed through into the vagina, where they were tied.

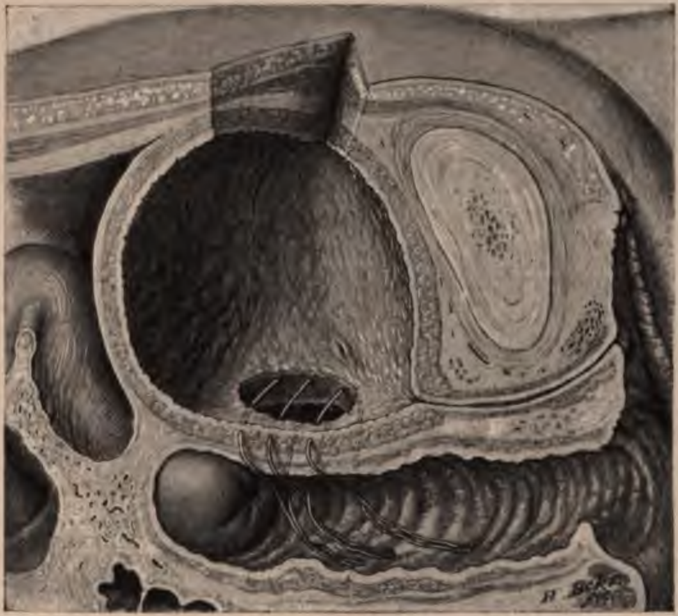


FIG. 261.—SUPRAPUBIC OPERATION FOR VESICO-VAGINAL FISTULA (TRENDELENBURG). SAGITTAL SECTION. SUPRAPUBIC INCISION SEEN ABOVE.

The incision into the bladder is now closed down to an opening left for a T-drain. The patient is compelled to lie in Sims' position until the fifth day, when she may turn over for a time on her back. The drainage tube is removed from the ninth to the twelfth day, after which the abdominal wound heals of itself.

While the attempt to close a fistula in this way failed in the first two cases, it succeeded in the following two. In the case described in detail by the author the fistula was the size of a plum stone, fixed by scar tissue, and associated with the loss of the right half of the cervix.

Dr. H. C. Coe's case, cited above, in which the uterus had been amputated for a parturient rupture, had a fistula to the left of the cervix situated in cicatricial tissue; a probe entered through the opening into the bladder, but not into the cervical canal, although there was a communication on that side as well, shown by milk injected into the bladder coming out of the canal. The operation performed was a unique one. He first divided the bridge of tissue separating the fistula from the cervical canal, and then pared the edges of the fistula and excised the entire remaining cervix, leaving nothing but vaginal mucous membrane to be included in the sutures along the entire line of the wound. The opening of the ureter was identified in the upper margin of the fistula and avoided. The wound was now closed by thirteen silver wire sutures and three silk ones. The recovery was complete.

Vesico-uterine Fistula.—The causes which produce a vesico-uterine fistula are the same as those producing some cases of cervico-vesico-vaginal fistula—that is, a tear of the cervix which extends through into the bladder, up into the uterus, and which in this group of cases heals in its lower part, leaving a persistent opening between the bladder and the cervical canal. The result of this is that the urine constantly dribbles out through the cervix into the vagina. If the opening is small, the patient may pass some urine naturally, leading the physician to the erroneous conclusion that the fistula communicates with one of the ureters and not with the bladder. This will be disproved by injecting milk into the bladder and seeing it ooze out through the cervix, and by examining the bladder with a cystoscope and inspecting the fistulous orifice, as well as by noting the fact that the discharge of the urine from the cervix lacks the peculiar intermittency of a ureteral flow. If necessary the ureters may be catheterized and their patency demonstrated.

The proper treatment of a vesico-uterine fistula is well described by F. H. Champneys (*Trans. of the Obst. Soc. of London*, 1888, vol. xxx, p. 348) in an article entitled "Description of a New Operation for Vesico-uterine Fistula."

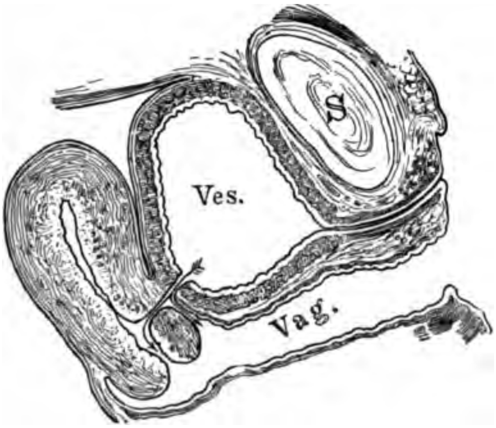


FIG. 262.—VESICO-UTERO-VAGINAL AND VESICO-UTERINE FISTULA IN THE SAME PATIENT.

The procedure is as follows: The patient, thirty-eight years old, had had four severe labors, the last two instrumental. Her pelvis was generally contracted and flattened, and the last labor continued four days when it was terminated by the forceps; on the same day the urine began to flow by the vagina, and continued to do so up to the day of the operation.

On examining *per vaginam*, the cervix was found rather large and flabby and the canal big enough to admit the index finger for an inch. On injecting the bladder a large stream escaped from the cervix, and a bent probe introduced through the urethra could be passed on directly into the cervical canal.

Operation May 12, 1887. *a.* After passing a probe through the fistula as just described, and bringing it out at the cervix, the latter was steadied with a vulsella forceps.

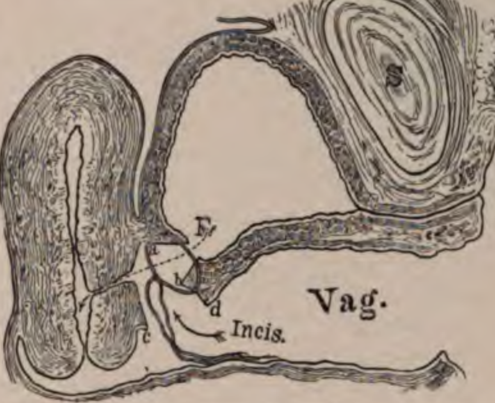


FIG. 263.—VESICO-UTERINE FISTULA TREATED BY DISSECTING THE BLADDER FREE FROM THE UTERUS AND SEWING UP THE FISTULA.

The long arrow shows the position of the fistula, the short arrow points to the line of incision in front of the cervix separating the cervix (*c*) from the vagina (*d*); the edges of the fistula (*a b*) are then approximated and (*c d*) united again.

b. A transverse incision 3½ cm. long was made through the anterior fornix from the vagina and the bladder, dissected up from the cervix with scissors and fingers as in a vaginal extirpation of the uterus. The dissection was carried well above the fistula, dividing it into two parts, one opening into the bladder and the other into the cervix, each admitting the index finger easily.

c. No freshening was required, as the whole surface was raw. Seven fine silver sutures were passed from side to side to close the opening in the bladder, each one being entered an eighth of an inch from the hole and brought out on its edge, avoiding the mucosa. Four similar sutures closed the cervix. These sutures were all cut short.

d. The vaginal wall was then united to the cervix by four long silkworm gut sutures, subsequently removed.

A self-retaining catheter was left in the bladder and a gauze pack put in the vagina. The result was a perfect recovery of function.

I operated January 12, 1893, on a somewhat similar case. The patient (F. H., 1750), forty-six years old, had had twelve children, the last two born instrumentally. At the last confinement she was four weeks abed instead of four days, as usual, and from the fourth day on she suffered from incontinence of urine.

Both vaginal walls were found lax and pouting, and the anterior lip of the cervix was completely destroyed. At a point well above the vaginal vault a fistula 1.5 cm. in diameter opened into the anterior cervical wall. This was treated by exposing the cervix with a speculum, drawing it down, and then cutting across the vault of the vagina, detaching the cervix from the bladder, and so separating the fistula for 1.5 cm. on all sides from the vagina and uterus, laying bare a hole in the bladder wall 8 mm. in diameter. This was closed by four silkworm gut sutures introduced from side to side, with fine catgut between for accurate approximation; the cervical part of the fistula was left open, and the vaginal vault was not closed. (See Fig. 263.) A vaginal pack was then put in and the bladder drained by a catheter.

In two weeks the silkworm gut sutures were removed and the union found perfect throughout.

Other Vesical Fistulæ.—Aside from the genital fistulæ which have just been discussed, fistulous communications with other organs are but rarely observed. This immunity is due to the fact that some unusual accident is necessary to establish a communication between the bladder and any of the other abdominal or pelvic viscera.

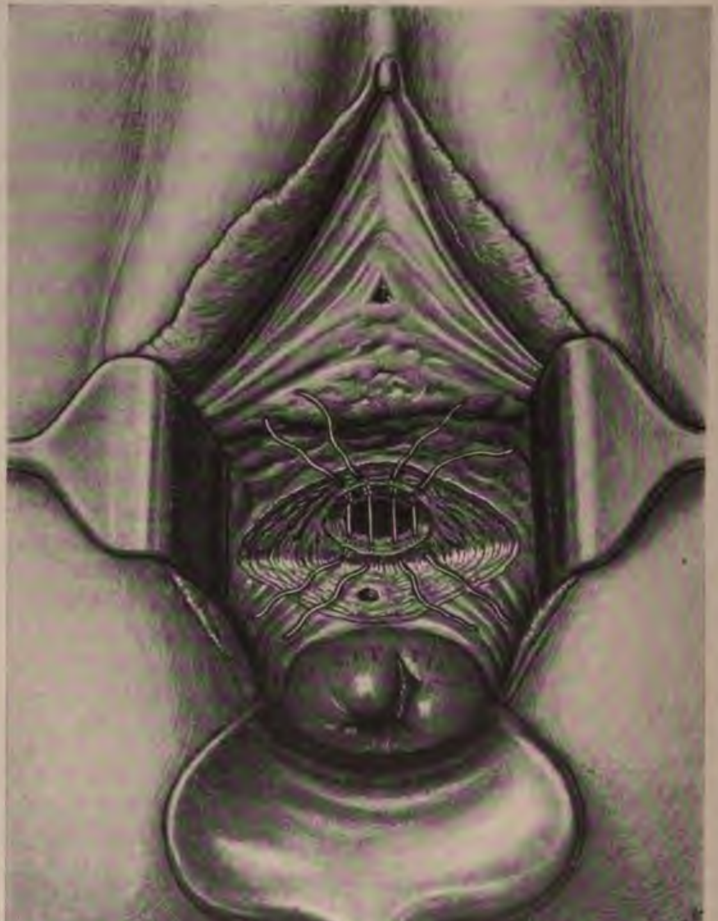


Fig. 264.—Vesico-uterine Fistula, Sutures closing the Bladder in Place but not yet tied.

A communication may be formed in this way between the bladder and a tube or an ovary, and between the bladder and the small or large intestine. Communication between the bladder and a tube or an ovary is brought about in one of two ways: either (1) an abscess of the tube or ovary perforates the broad ligament at its base and so finds its way into the bladder, or (2) an ovarian tumor forms adhesions with the peritoneal portion of the bladder, the septum becomes thinned out and finally breaks, and the contents of the cyst escape by this avenue.

An abscess perforating the broad ligament commonly finds its way into the bladder in the neighborhood of the right or left cornu—that is, at either end of the posterior fold. I have seen a case of a tuberculous abscess of the tube on the right side of the pelvis discharging in this way.

A suppurating dermoid cyst may break through into the bladder and the nature of the abscess be determined by the escape of hair (pilimiction) or bones discharged *per urethram*, or even by a tooth found as the nucleus of a vesical calculus. A case of this sort is well described by Dr. G. C. Blackman (*Amer. Jour. of the Med. Sciences*, January, 1869, p. 49). The patient, thirty-six years old, first noticed air escaping from the bladder, then urine passed by the rectum, and she suffered from a cystitis. A calculus was found and removed. This contained a tooth, and in the course of seven years four similar calculi containing teeth as nuclei were extracted. Some months after the last one was removed she began to pass hairs incrusted with phosphatic deposits. Dr. Blackman gives a careful review of the literature of the subject.

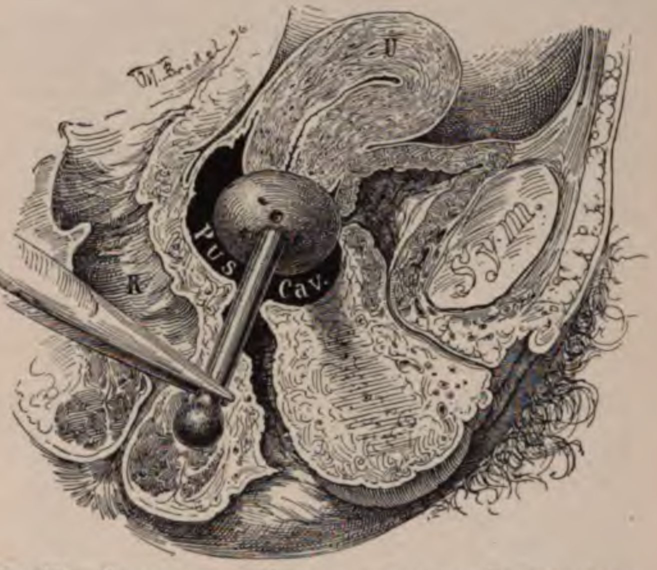


FIG. 265.—VESICO-VAGINAL FISTULA, CAUSED BY A PESSARY; SEEN IN SAGITTAL SECTION.

The shank of the pessary lies buried in the recto-vaginal septum. The vagina is atresic and the pus cavity in its upper portion discharges into the bladder, which lies contracted behind the symphysis, by a fistulous opening caused by the cup of the pessary. The hypertrophy of the vesico- and urethro-vaginal septum is shown, as also in Fig. 264.

Fig. 267 shows the condition found in a patient of Dr. Henry Elsner, of Syracuse, N. Y., in a case of pyuria due to a dermoid cyst. The patient, forty years old, had known of the existence of the tumor for over twenty years. Three years before the operation the previously movable tumor became fixed above the symphysis, and for the same length of time she suffered from a pyuria.

The tumor was found at the operation to be a right dermoid cyst densely adherent to and discharging its contents into the bladder; after freeing numerous surrounding adhesions, the dense, fibrous sinus, 3 cm. in diameter, was dissected out down to the bladder just above the symphysis pubis and cut off, exposing a lumen of about 3 mm.

This was closed by six interrupted buried catgut sutures and the vesical peritoneum was then drawn over it and united by six more catgut sutures, leaving a longitudinal linear wound at the site of the attachment. . No drain was used. The pus disappeared at once and a perfect recovery followed. When drainage is necessary it is easy to make the wound entirely extraperitoneal by uniting the peritoneum from the bladder up on to the abdominal wall, so as to leave whatever space is desired between the peritoneum and the symphysis.

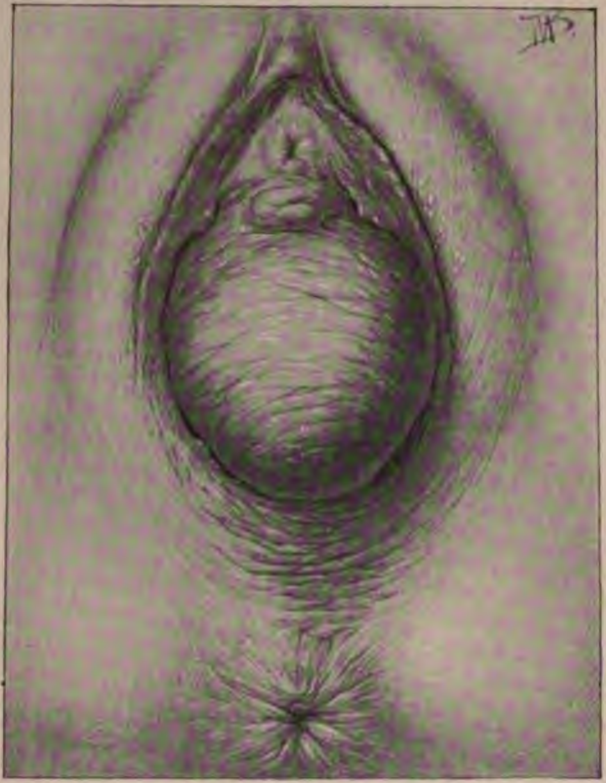


FIG. 266.—ENORMOUS HYPERTROPHY AND EDEMA OF THE ANTERIOR VAGINAL WALL SIMULATING CYSTOCELE, DUE TO CYSTITIS. Nov. 27, 1895. (See Fig. 265.)

An extra-uterine sac may also suppurate and open into the bladder, and the nature of the affection first be made clear by the escape of one of the bones through the urethra.

Therig (*Centralbl. f. innere Med.*, Bd. xv, p. 97) has observed in women two cases of paratyphlitic (vermiform appendix ?) abscesses breaking into the bladder; both recovered under irrigation. (See also "The Vermiform Appendix and its Diseases," Kelly and Hurdon, 1905, pp. 197 and 318.)

A case of colo-vesical fistula is reported by R. Harrison (*Twentieth Century Practice*, New York, 1895, vol. i, p. 222). Air bubbles escaped through the urethra, and granular cells and spiral vessels were found in the urine; after death the colon was found adherent to the bladder and a cherry stone was lying in a diverticulum among the adherent intestines. The *débris* in the urine evidently came from the disintegrating kernel of the stone.

The symptoms produced by the communication of any of these extravesical sacs with the bladder are those of cystitis, often with fever and chills, the admixture of varying amounts of pus with the urine, and, it may be, other elements which characterize the kind of tumor.

The diagnosis will be made by the ordinary, routine, cystoscopic examination, which reveals the secondary catarrhal condition of the vesical mucosa and the more intense area of inflammation around the fistulous opening in whatever part of the bladder it is located; also by passing a searcher into the fistula, and in some cases on into the sac. The bimanual examination will also often show the presence of an inflammatory mass in close communication with the bladder, and in an entero-vesical fistula the passage of air bubbles by the urethra is significant.

In the case of tuberculous abscess referred to above, I found pus in the urine, varying in quantity at different times, and occasionally tubercle bacilli. The inflammation in the bladder was most intense at the right cornu—that is, in front of the right broad ligament, where there was a group of fleshy granulations. A little bubble of air oozing out between these, observed one day when the patient was being examined in the knee-chest position, revealed the presence and position of a fistulous orifice. An examination under anesthesia now showed that the right tube and ovary were contracted down into a small hard mass adherent to the base of the broad ligament, through which they communicated with the opening in the bladder.

Dr. C. P. Noble, of Philadelphia (*Med. and Surg. Reporter*, January 19, 1889), had a case of recto-vesical fistula following an ischio-rectal abscess five years before. After the abscess discharged she passed wind and small pieces of fecal matter by the urethra at irregular intervals.

At the examination an old extensive scar from a pessary was found on both sides and in the posterior fornix of the vagina, but no fistula could be found after the most careful search. At Dr. Noble's suggestion, however, on the following day hydrogen gas was forced into the rectum, which found its way into the bladder, and was lighted at the end of a catheter introduced into the urethra.

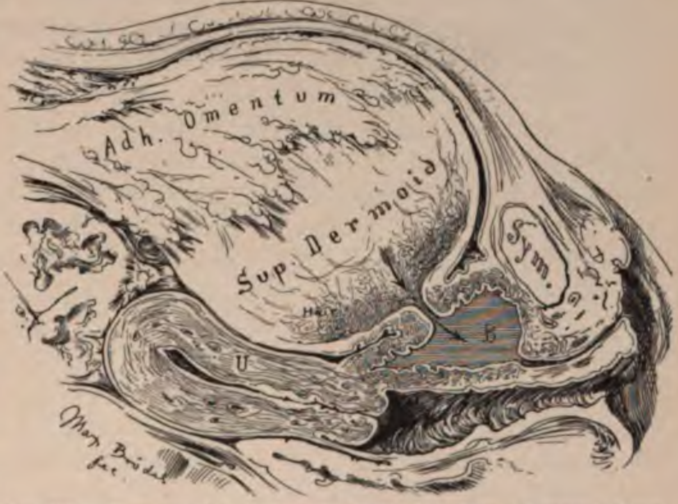


FIG. 267.—PYURIA DUE TO SUPPURATING ADHERENT DERMOID CYST OPENING INTO THE BLADDER (B). DEC. 17, 1896. (See p. 439.)

Treatment.—The proper line of treatment must depend on the individual case; no general rules can be laid down. The local affection of the bladder tends to a spontaneous recovery when the cause is removed. If the patient's health will permit it, a sac which opens into the bladder should, therefore, either be enucleated and the source of the discharge stopped, or evacuated and drained in some other direction—into the vagina, or by the abdominal wall—so as to give the bladder a chance to recover.

In one of the worst cases of pyuria I have ever seen a cure was effected by opening and draining the abscess, which lay in front of the uterus, through the anterior fornix in the vagina. In another case a pelvic abscess on the right side, discharging through the bladder, was relieved by enucleating both tubes and ovaries with the uterus, leaving the vaginal portion of the cervix, which was sewed over the fistulous orifice at the base of the broad ligament, so as to divert any discharges into the vagina. The fistula could not be closed by direct suture on account of the friable inflammatory tissue composing its walls.

HEMORRHOIDS.

Varicose Bladder.—A hemorrhoidal condition of the bladder or vesical varix is a rare affection, in spite of the fact that all the favoring conditions for its frequent occurrence seem to be supplied in the venous stasis so often found in the pelvis, in the enormous congestion of hemorrhoidal venous sinuses, as well as in the congestive disturbances found in association with retroflexion of the uterus. The frequency of inflammatory disturbances in the neighboring genital organs, and the great development of crural and labial varices in pregnancy, as well as the increased amount of blood observed in the bladder in that condition, would all lead one naturally to expect to meet with a varicose condition of the bladder as a common occurrence under these circumstances. When found in men vesical varix is apt to be associated with rectal hemorrhoids. The cause of vesical varix has been shown in them to be due to an insufficient size of the venous channels above the communication of the hemorrhoid and the vesical plexuses, so that a lower rectal congestion brings with it at the same time a vesical stasis. In 1854, Guyon exhibited a case at the Anatomical Society of Paris in which the neck of the bladder was surrounded by a varicose venous circle with diverging dilated submucous ramifications.

H. Picard (" Traité des mal. de la vessie," Paris, 1878, p. 284) found in an autopsy on a man who died of this disease that the large venous plexuses surrounding the prostate communicated with the hemorrhoidal plexus. The mucosa of a large part of the bladder itself bristled with a great number of varices, forming little bluish tits about its neck, on the base, and extending high up on the lateral walls. Each little tit-like projection was the elbow of a vein projecting from 1 to 2 mm. beyond the surface of the bladder. Some of the vessels near the neck showed abrasions, and others were perforated, demonstrating the source of hemorrhage, and probably of the infection of which the patient died.

In the clinical history the one characteristic symptom is the repeated hemorrhages. In men retention of the urine has also been noted as a common symptom.

The diagnosis between this condition and papilloma, or cancer in its early stages, is difficult; it must be made by symptoms and an external examination. If the hemorrhages come on with an attack of the piles, vesical varix may be suspected, especially if difficulty in urination occurs at the same time. Vesical varix is also found when there is a periodical bleeding alternating between the rectum and the bladder.

All doubt may be easily cleared up in women by making a direct cystoscopic examination of the mucous surface of the bladder, when the blue congested vessels may be easily inspected and their number, size, and distribution determined. In such a case it is better to examine first in the dorsal position under a moderate degree of elevation, to avoid the tendency of the knee-chest position to produce an artificial anemia, temporarily relieving the very condition it is desired to see. The inspection should be carefully extended over the whole circumurethral area, and from thence down the urethra as the speculum is withdrawn.

Arbuthnot Lane, at a meeting of the Clinical Society of London (*Lancet*, March 18, 1895, vol. ii, p. 1252), reported a rare condition under the title of "A Nævoid Growth of the Mucous Membrane of the Bladder."

A child, aged three years and a half, had been passing bloody urine for two years, the blood at times coming away in large clots. When seen by Lane the hemorrhage was so severe and had been so long continued as to endanger life. On examining the patient, several nævoid patches were seen around the anus and on the buttocks. By abdominal palpation the bladder could be distinctly felt above the pubes. When the bladder was opened above the symphysis pubis, large nævoid masses, some as large as grapes, protruded through the wound; most of these were soft and bled easily; a few were hard and apparently cystic. Almost the whole of the mucous surface of the bladder was affected.

As an operation seemed to be practically out of the question, the incision was closed, and afterwards the hemorrhage practically ceased, the urine being only a little blood tinged at times.

Treatment.—If the discovery of the varicose condition is made accidentally, and there are no urgent symptoms, nothing should be done, but in a persistently bleeding case occurring in a woman, after diagnosing the cause of the bleeding and locating its position in the bladder, one of several plans may be followed; in a mild case the galvano-cautery introduced through the speculum may be used over small areas at several sittings.

If the urethra is dilated to admit a No. 15 to 18 speculum, one or even more ligatures may then be easily thrown about several of the larger venous trunks by means of a fine curved needle on a fixed handle carrying fine silk, which can then be tied by using a little instrument pronged like a pitchfork to afford a point of counter-pressure within the bladder. A more active and direct interference may be made by means of an incision through the anterior

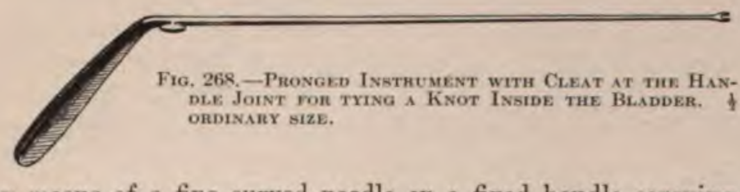


Fig. 268.—Pronged Instrument with Cleat at the Handle Joint for tying a Knot Inside the Bladder. ½ ordinary size.

vaginal wall, everting and exposing the veins at the neck of the bladder. Several of the larger trunks may then be tied with fine silk and the vaginal incision closed again.

Dr. W. Ryan, of Springfield, Ill., had a case of varix in a woman which he successfully treated by a suprapubic incision. The patient was thirty-one years of age and married; for six months had passed large quantities of blood with her urine, in clots; whenever the bladder became distended with the clots her suffering was extreme. She was so anemic and in such a generally depressed state of health that several of her physicians thought she was suffering from a serious renal affection. There were no rectal hemorrhoids at all. Washing out the bladder and the use of injections only made her worse.

On December 19, 1890, Dr. Ryan opened the bladder above the symphysis pubis and found an extensive dilatation of the veins about the neck of the bladder, at the base, and running up on the sides just under the intact mucosa, about 2 mm. in diameter. In opening the bladder, some veins about the neck were cut, and continued to bleed moderately, through a drainage tube which was left in for five days. After this simple treatment, consisting only of incision, inspection, and drainage, she made a perfect recovery.

HYPEREMIA.

By hyperemia, or a congestion of the vascular system of the bladder, is meant a flushing of the vesical capillaries, local or general, which produces an increased redness of the surface, in contradistinction to a hemorrhoidal condition, where the venous trunks are involved and the capillary veins are greatly distended. A physiological hyperemia of the bladder may be observed when nature determines any large amount of blood to a neighboring organ, as, for example, in pregnancy. A localized hyperemia of the vesical mucosa is often found, also associated with inflammatory disease in the immediate neighborhood. The withdrawal of the obturator from the end of the vesical speculum always produces a little patch of hyperemia on the posterior vesical wall by acting for a moment as a piston and sucking the vesical mucosa into the end of the speculum.

Hyperemia of the Trigonum.—This is a common condition localized in the trigonum, and rarely extends beyond its limits, except into the urethra.

The entire surface of the trigonum may be of a deep rosy red, the injection extending around both ureteral orifices; the border of the injected area becomes gradually merged into the surrounding sound tissue. The surface of the mucosa sometimes has a slightly puffy or edematous appearance. The injection may be of a patchy nature only surrounding the ureteral orifices, or it may even be limited to the neighborhood of one ureteral orifice.

The margins of the injection when not limited by the interureteric line are irregular in outline. The most intense injection is often in the area closest to the urethra, which is also deeply injected in its upper part, and characterized by prominent lacunæ.

The symptoms produced by a hyperemia are characteristic. The patient suffers from a desire to empty the bladder at frequent intervals, either by day or by night, or both; she often complains of a burning or bearing-down sensation, or of a feeling of fullness about the neck of the bladder. The act of urination is sometimes painful, but not always; very often after urinating there is a distressed feeling about the parts, which persists for some minutes or even an hour or more, leaving her much depressed. Other patients may not feel the desire to urinate more frequently than ordinary, but the distress is experienced afterwards. The whole area is extremely tender to the touch either by the end of the speculum or a probe.

The causes of this disease are sometimes difficult to determine. I find it in all those cases which have hitherto been diagnosed as " irritable bladder," or " teasing of the neck of the bladder from retroflexion of the uterus," or " pressure of an anteflexed uterus on the bladder," or " neuralgia of the bladder "; it is also the only lesion existing in many of the cases under treatment for a supposed cystitis.

It is frequently observed after abdominal pelvic operations, and appears to be due in these cases to the irritation of the vesical mucosa by the highly concentrated urine discharged during the first few days. I have for the past two years almost eliminated it from my wards by giving every such patient a large rectal enema of normal salt solution before she leaves the operating table; the salt solution dilutes and greatly increases the flow of urine.

Another fruitful cause of hyperemia of the trigonum is the slight mechanical insult of catheterization. It may be that a mild infection lies at the bottom of some of these cases, and that the affection is in reality a form of trigonitis, but this remains to be proved. One of the commonest causes of hyperemia is an excessively acid urine in neurasthenia (T. R. Brown).

Diagnosis.—The diagnosis will not be difficult if all cases of " vesical irritability " are examined by the direct method.

The marked redness in the trigonum is at once apparent, and the evidence is still more decided when there is a patch of it on one side while the other remains clear. Often the patient complains bitterly when the end of the speculum touches this spot, and if it is touched with a searcher she will declare at once that the seat of her discomforts is located there.

The examiner must guard against two errors in making the diagnosis: First, he must not mistake the physiologically greater injection of the trigonum over that of the rest of the bladder for a hyperemia; he will avoid this by familiarizing himself with the appearance of the normal trigonum, and allowing for the slight difference in color which always exists.

In the second place, he must not mistake the hyperemic blush about a ureteral orifice, which is so commonly met with as a sign of disease of the kidney or ureter of that side, for a simple hyperemia. A few leucocytes are sometimes found in the urine when the hyperemia is intense.

Treatment.—The treatment should be directed to the cause when it can be discovered. If it follows an operation, recovery is usually spontaneous within two or three weeks. If the urine is highly charged with urea, diluents should be given; water and flaxseed tea, and citrate of potash and lithia in large doses are all useful in relieving acidity. I have found most relief given by half-teaspoonful doses of sweet spirits of niter repeated every two hours; fluid extract of zea maïs and triticum repens in half-teaspoonful doses are valuable, particularly the first remedy. Such articles of diet as tomatoes, fruits, or acids, should be avoided when the patient finds that they aggravate her condition. The bowels must be kept well opened all the time. A prolonged hot vaginal douche often gives great relief.

When these means fail, direct topical treatment should be begun by placing the patient in the knee-chest position, exposing the affected area, and applying a 3 to 5 per cent solution of nitrate of silver to the affected area alone. It is easy to do this with a little absorbent cotton twisted on a wire applicator. These applications may be repeated every three to five days as long as the morbid condition continues to improve.

CYSTITIS.

Bacteriology.—Cystitis is a disease much less frequent in women than in men, and exceedingly rare in children. An infection is the true cause of every case of cystitis, and the continuance of the disease depends upon the continued action of one or other of the various pathogenic micro-organisms. The term cystitis is therefore a collective name for a variety of inflammatory affections having certain symptoms in common in their early stages, but often differing widely in their final forms.

The commonest avenue of infection is through the urethra, in which numerous organisms are constantly found normally; these organisms, together with organisms from the vulva lodged on the external urethral orifice, may be carried into the bladder by the catheter, sound, or other aseptic instrument, or they may be introduced on unclean instruments, and the infection lighted up in this way. It is also necessary to allow for a few cases in which the organisms enter the bladder from the urethra without instrumentation, especially where the urethra is dilated and patulous, as in women who have borne many children.

The bladder may also be infected from the kidney, either when the kidney or its pelvis is diseased, as in pyelitis or pyelonephrosis, or, as has been shown, even when the kidney itself is healthy, the organisms may be eliminated from the body through it, and so may infect the bladder. A claim has also been made by Wreden (*Arch. des Sciences Biologiques*, St. Petersburg, Bd. ii, 5, 1894) that a direct infection of the bladder may take place from the intestine under certain conditions; in support of this are the experiments upon animals, occluding both rectum and urethra, with the invariable result of occasioning a true cystitis, in which usually pure cultures of the organism used in the experiments may be isolated from the bladder.

C. Posner and H. Lewin report a series of experiments (*Centralbl. f. Harn und Sexual-Organe*, Bd. vii, Heft 7, 1896) which throw much light upon this question of a direct infection; they found, after closure of both the rectum and the urethra, that while they were always able to get pure cultures from the bladder of either the colon bacillus or the special organism used, these organisms were always present in the blood, and in the substance of the kidneys as well; so that although the result of the investigation does not entirely preclude the possibility of a direct passage of the intestinal bacteria into the bladder, it renders it less probable, while the chances are that the infection travels through the blood into the kidneys and so enters the bladder. In several cases they injected coloring matter into the rectum, but in no instance did it appear in the bladder or the bladder wall. The entrance of the organisms into the blood is explained by the fact that there was always some wound of the intestine or rectum, from the clamp or a ligature, opening up an avenue for their direct passage into the finer blood vessels or into the lymphatics.

It is also possible that, as a result of the ligation changing the circulatory conditions from the normal, the organisms may have penetrated the unwounded intestinal wall, and so have entered the lymphatic circulation. That this sometimes occurs in the human being is beyond question, for we know that while the bacteria are unable to pass through the normal intestinal mucosa, they do penetrate the mucosa and enter the peritoneal cavity when the vital activity of the intestine is lowered or dead, as, for instance, where there is a strangulation of the intestine, or where the blood supply is cut off. The colon bacillus is not infrequently found free in the peritoneal cavity under such circumstances.

On the other hand, Reymond (*Ann. des mal. des organes gen. urin.*, April, 1893) has proved beyond any question that bacteria can enter the bladder directly from inflammatory areas in the neighboring organs. He was struck by the frequent occurrence of cystitis in women suffering with inflammation of the uterus or of the uterine tubes, and in most cases he proved by culture that the organism was the same in both organs; as an additional proof, he found, in a case of salpingitis in one tube, a localized cystitis on the same side in the bladder. To complete his chain of evidence it was necessary to show that the organisms could pass directly through the walls of the bladder from the neighboring inflamed area. To do this he laparotomized dogs and injected 2 or 3 cm. of a culture of the urobacillus liquifaciens of Krogius which he had isolated from a case of salpingitis and cystitis, under the peritoneum covering the bladder.

Ten hours later, on removing the ligature from the penis, he found a cystitis present, and was able to obtain pure cultures of the urobacillus from the bladder, cultures from the blood and kidneys remaining sterile. He also demonstrated the organisms in the bladder walls under the spot where the inoculation was made, and at this place the cystitis was most marked, showing in one case an ulcerated area. By further experiments he proved that the organism was able to penetrate the peritoneum.

The clinical cases, together with the experiments on animals, prove his conclusion that cystitis may arise from the passage of organisms directly from a diseased tube or ovary, the blood, kidneys, and other organs remaining sterile, when the predisposing condition is present in the form of a congestion of the bladder caused by the neighboring infected area.

Finally, the infection may come from rupture into the bladder of purulent collections in the other abdominal viscera, as, for instance, in the rupture of tubal, ovarian, or perityphlitic abscesses.

The direct predisposing causes are still to some extent unknown. We do know, however, that in the normal bladder, though there are often pyogenic organisms present, cystitis is not set up; this has been amply proved by experiments both on the lower animals and on the human being, for we know that the typhoid bacillus and many other pyogenic organisms are excreted by the kidneys and pass through the bladder without the least harm being done. This fact gives us an important starting point for our investigations, as it proves that the presence of the bacteria alone is insufficient to cause an inflammatory reaction in the normal bladder.

Melchoir (" Cystite et infection urinaire," Paris, 1895) found in numerous experiments, after injection of cultures of the various pyogenic organisms, and ligation of the urethra to cause retention, that he was always able to produce a cystitis in animals, the urine containing blood, pus cells, and many bacteria; cystitis superinduced in this way clears up, however, in a few days. This explains the frequent occurrence of cystitis in old men with enlarged prostate glands, and also in women who are suffering with prolapsus of the uterus dragging down the bladder; in both cases there is always a certain amount of residual urine in the bladder.

Melchoir also found that after a slight traumatism of the bladder wall cystitis occurred readily, and under this head we can place the cystitis following catheterization and instrumentation of the bladder, also the cystitis following childbirth.

Stone in the bladder, by pressure and injury to the vesical walls, is often a predisposing cause, and cystitis very often accompanies the growth of either benign or malignant neoplasms of the bladder walls. Further, the ingestion of irritating drugs by their irritating or caustic effects on the vesical mucosa, prepare a suitable soil for the entrance of the bacteria. The scanty urine highly charged with urea and various other salts, which is excreted after operation, also acts in the same way. Finally, the congestion of the bladder as a result of pelvic inflammation is an important cause, as proved by Reymond.

The alkaline or ammoniacal urine which was formerly considered as a cause of cystitis is now known to be merely a secondary result of it; it follows the decomposition of the urea into carbonate of ammonia, this decomposing power being the property of certain bacteria.

Many different organisms have been isolated in cystitis. Clado (" Étude sur une bacterie septique de la vessie," Paris) found one bacterium occurring very often which was so virulent in character when injected into mice, that he turned his attention entirely to it; he describes it under the name of "Bacterie septique de la vessie." Since the work of Clado many articles have appeared describing various other organisms found in urine taken from cases of cystitis.

Albarran and Hallé ("Note sur une bacterie pyogène et sur son rôle dans l'infection urinaire," *Bull. de l'acad. de méd.*, 1888) describe an organism found by them in forty-seven out of fifty cases of infection of the urinary tract, the organism being present in pure culture in fifteen out of the forty-seven cases; this was named by them "bacterie pyogène."

Rovsing ("Blasen-Entzündungen," Berlin, 1890) studied the urine from thirty cases of cystitis, all but three of which were ammoniacal, and found in five of the thirty the tubercle bacillus, in eight the staphylococcus pyogenes aureus, and in three the staphylococcus pyogenes albus and citreus; he also found in the other cases various undescribed organisms—the streptococcus pyogenes ureae, the diplococcus ureae pyogenes, in two cases the cocco-bacillus ureae pyogenes, and in one case micrococcus ureae flavus pyogenes.

Krogius, the author of several articles on the bacteriology of cystitis and other urinary infections, has come to the conclusion that the organism, a short bacillus commonly found by him, was in fact an intestinal bacillus, probably the colon bacillus.

Melchoir published in 1895 the results of the bacteriological examinations in thirty-five cases of cystitis, and found that among these the colon bacillus was present in pure culture seventeen times, and present altogether twenty-four times. The streptococcus pyogenes was found four times, the proteus of Hauser four times, the tubercle bacillus three times, and the gonococcus and typhoid bacillus each once; the remaining organisms were undescribed until he isolated them.

Melchoir also thinks that the organisms described by Clado, as well as those described by Albarran and Hallé, and also by Morelli, are in fact only the colon bacillus which he found so many times, and he compares the modes of growth, size, and general morphology in a convincing manner.

Besides the above, Heyse (*Zeitschr. f. klin. Med.*, Bd. xxiv, 1894, p. 130) has described an interesting case of cystitis from infection by the bacillus lactis aërogenes, with the formation of gas in the bladder. He traced the infection from the intestines, where the bacillus was present in large numbers, to the vagina where it had also evolved gas, whence it had evidently been carried into the bladder by catheterization. Heyse also cites a case of pneumaturia described by Senator, who found the torula cerevisiae to be the cause of the gas formation in a diabetic patient.

The bacillus aërogenes capsulatus of Welch has also been isolated from several cases of pyelonephritis, and in one case reported by Goebel, from an autopsy performed at the Hamburg General Hospital, on an old man who had an enlarged prostate, the bladder was found filled with gas, and there were numerous gas blebs beneath the mucous membrane.

Fr. Vahle (*Inaug. Diss.*, Marburg, 1895) describes a case of exfoliative cystitis in a woman suffering with a myoma incarcerated in the pelvis, in which the organism present was the streptococcus pyogenes; the patient died later of a septic peritonitis.

As in the bacterial infections in other parts of the body, we are likely to find in cystitis two or more varieties of organisms present at the same time, or, in other words, a mixed infection. This is especially likely to be the case in the more chronic forms of cystitis.

For example, Melchoir found in one case of cystitis accompanying carcinoma of the bladder the bacillus coli communis and the proteus of Hauser; in another case of cystitis of long duration, following a urethral stricture, the bacillus coli communis and the streptococcus pyogenes; and in still another case of long-continued cystitis the proteus of Hauser and the streptococcus pyogenes.

The pathogenic bacteria which have been most commonly isolated from the inflamed bladder may be summarized as follows:

The bacillus coli communis, the streptococcus pyogenes, the staphylococcus pyogenes albus, citreus, and aureus, the bacillus lactis aërogenes, pyocyaneus, urobacillus liquifaciens, the gonococcus Neisser, the typhoid bacillus, the tubercle bacillus, and several varieties of the proteus.

One can well see from this list that almost any pyogenic organism, entering the bladder under favorable conditions, may set up an inflammatory action.

Certain of these micro-organisms seem to follow some definite route of entry to the bladder; the gonococcus, for example, always travels up the urethra, and the cystitis which develops from it belongs to the group of ascending infections; the colon bacillus may take the same route, or it may penetrate the tissues and pass more directly from the bowel into the bladder. This is especially likely to happen if the bowel is adherent to the bladder or opens into it.

The bacillus tuberculosis is almost always a descending infection, finding its first habitat in the kidney, and then traveling down the ureter to the bladder.

Finally, a condition has been described by H. Krogius ("Annales des maladies des organes genito-urinaires," 1894, pp. 96, 210), B. Goldberg (*Centralbl. f. Harn und Sexual-Organe*, Bd. vi, 1895, p. 352), and others under the name of "bacteriurie," in which, with no sign of cystitis except the presence of a few pus cells, the urine when voided simply swarms with bacteria and often has a peculiar fetid odor.

To summarize, we find the following facts:

1. That cystitis is always caused by the presence of bacteria.

2. That the mere presence of bacteria is insufficient to cause a cystitis, a further predisposing cause is necessary.

3. That there are various modes of entrance for bacteria—through the urethra, through the ureter from the kidney directly, from inflammatory areas in the uterus or uterine tubes, and probably from the rectum under like conditions; still another probable avenue of entrance is through the blood.

4. That under favorable conditions any pathogenic organism may give rise to cystitis.

No tests as to the bacteriological condition of the urine from the bladder are of any value unless proper precautions have been taken to avoid the accidental contamination of urine by organisms from the vulva or from the external urethral orifice. I have found the following plan of securing uncontaminated urine a satisfactory one: the glass catheter is sterilized with a rubber sleeve covering the outer end, as shown in Fig. 269. The vulvar labia are separated under a good light and the urethral orifice gently but thoroughly cleansed with a wet pledget of sterile cotton held in a forceps. The sterile catheter is then introduced, held by its rubber cover and without touching the vesical end. As soon as the urine begins to flow into the vessel A, the rubber sleeve is withdrawn and the uncontaminated urine is received in the sterile test tube B for bacteriological examination.

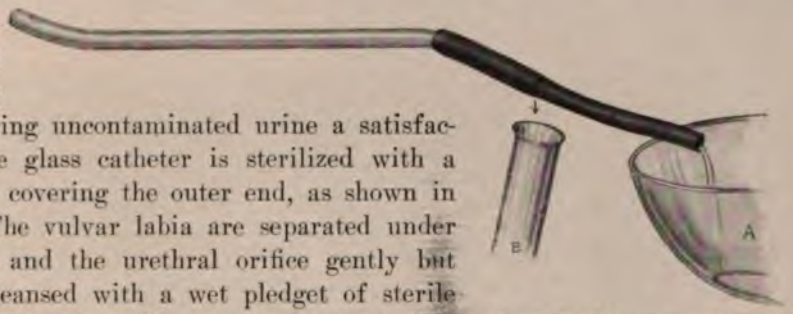


FIG. 269.—METHOD OF SECURING UNCONTAMINATED URINE.

After introducing the sterile catheter through the cleansed urethral orifice, the urine is allowed to flow into the vessel A, after which the rubber sleeve is drawn off from the end of the catheter and the urine is caught in the sterile tube B and kept for a bacteriological examination.

Distribution of the Inflammatory Area.—From a purely clinical standpoint cases of cystitis may also be classified, according to the location and distribution of the inflamed area, as—

Diffuse cystitis (cystitis diffusa), involving the entire mucosa of the bladder;

Circumscribed cystitis (cystitis circumscripta), where the disease is confined to a patch;

Scattered cystitis (cystitis dispersa), where the disease is distributed in patches over the surface.

Such a division of the forms serves to direct the attention to a fact of the utmost importance, hitherto overlooked in the treatment of these cases—that the cystitis is not always a disease of the entire mucosa of the bladder, but is far oftener found in patches with sound areas between, the sound portion usually preponderating. The practical corollary from this is, that it is irrational to treat the whole inner surface of the bladder by the injection of a strong solution which may seriously harm the sound mucosa.

According to the location of a circumscribed cystitis, it may be designated as trigonal, periurethral, fundal, apical posterior, right or left lateral.

If we add to this description of the form and location of the disease the name of the pathogenic organism, the outlined description becomes fairly complete; for example, we often have a cystitis trigonalis (gonococcus), a cystitis posterior (tuberculosa), or a cystitis universalis (bacillus coli communis).

Pathological Anatomy.—In acute cystitis the mucous surface of the bladder becomes intensely red and swollen, and sometimes ecchymotic; in the chronic forms the bladder becomes discolored and grayish, the mucosa thickened and the tissue beneath it infiltrated.

In the more advanced stages there is a breaking down of the tissues in the center of the inflammatory area and an ulcer is formed. An ulcer of this kind, characteristically linear, is shown in Fig. 270; in other instances the ulcers are small, round, and grouped. When the inflammation is localized in the trigonum the ulcer formed often gives rise to excessive hemorrhages, runs a protracted course, and responds slowly to all but the most energetic plan of treatment. (See Fig. 271.)

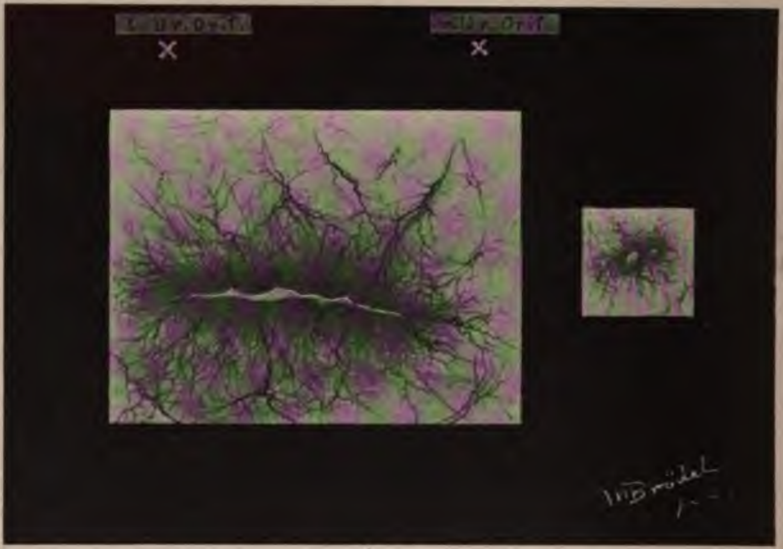


Fig. 270.—Linear Ulcer of the Bladder on the Posterior Wall, appearing as a Yellowish-white Surface surrounded by an Area of Intense Injection, about 3 Mm. broad; this again is surrounded by an Area of Injected Large Vessels, which appear to center in the Ulcer.

The location of the ulcer is shown by the ureteral orifices. Two other small round ulcers in the same bladder, shown in their relative positions near by. Patient of Dr. P. Harris. Exam. Jan. 19, 1897.

When the inflammation extends into the muscular vesical wall (cystitis parenchymatosa), abscesses may form and rupture into the bladder. In exfoliative cystitis the entire mucous lining may be thrown off like a cast, often bringing with it some of the muscular coat.

Clinical History.—The chief symptom common to all cases of cystitis is the frequent passage of urine accompanied with pain, most marked when the disease is situated near the neck of the bladder. The frequency varies from an hourly evacuation all the way down to one every five or ten minutes; tenesmus exists when there is great straining, with the passage of small amounts of urine.

The amount of urine evacuated at one time varies from 15 to 20 c.c. to but a few drops, and its emission is not followed by any sense of relief. The urine passed is turbid, flocculent, or contains mucus, and, in aggravated cases, blood. Pressure over the symphysis and on the base of the bladder through the vagina is painful, and can not be borne in a severe case. Fever and chills are absent, as a rule, and, if present, usually indicate an involvement of one of the kidneys by an extension of the infection up the urethra. Any instrumental examination of the bladder is so painful that it ought not to be persisted in without anesthesia; for the same reason catheterization ought not to be practiced.

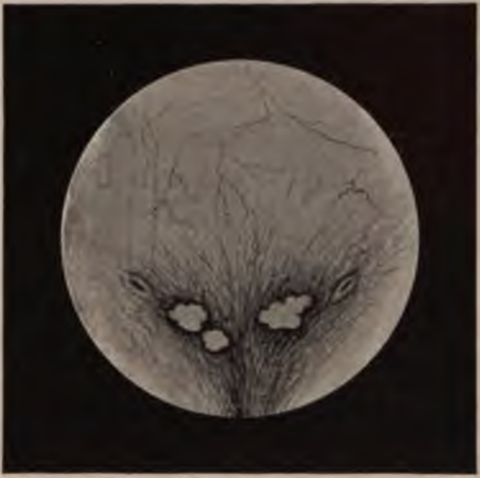


FIG. 271.—ULCERS OF THE TRIGONUM OF THE BLADDER, LOCATED BETWEEN, AND A LITTLE IN ADVANCE OF, THE URETERAL ORIFICES.

Note the white surface of the ulcers and the deeply injected margins. Patient of Dr. Neff.

When the mucous secretion is in excess, but few corpuscles are found in the urine; in other cases, when there is a higher grade of inflammation (cystitis purulenta) there is a marked amount of pus deposited.

Gas in the urine (pneumaturia) comes from the gas bacillus (see Heyse, *Centr. f. klin. Med.*, Bd. xxiv), or from the decomposition of diabetic urine; gas is also observed when there is an entero-vesical fistula.

The duration of a cystitis varies from a short-lived affection to one of years' standing; the gonorrheal cases in women are most apt to recover quickly and spontaneously. The catarrh of the bladder, which is found associated with calculus, recovers when the cause is removed. The most protracted cases are those of tubercular origin and those following labor. When cystitis is associated with a diphtheritis or gangrene of the bladder the termination is speedily fatal. In cases of old standing the muscular walls may become so hypertrophied as to form a hard mass like a tumor behind the symphysis.

Diagnosis.—It is always easy to diagnose a case of cystitis if the proper examination is made; this includes (a) a history of the illness, (b) examination of the urine, and (c) an examination of the mucous surface affected.

Many women actually under treatment for cystitis suffer only from hyperemia of the trigonum, or mild inflammation of the upper urethra; with a careful examination of the urine and inspection of the bladder such a mistake in diagnosis could not occur. The history of the case includes the characteristic symptoms just referred to, either coming on gradually or dating from some particular occasion; strangury and tenesmus are the most important of them. The examination of the urine reveals the presence of bacteria, and when they are found in pure culture they are usually the cause of the cystitis.

In tubercular cystitis the discovery of only a few of the characteristic tubercle bacilli, made after repeated searches, will be sufficient to make the diagnosis clear. In one of my patients, my associate, Dr. J. G. Clark, exposed an ulcer in the bladder distended with air, and curetted off a little portion, in which numerous tubercle bacilli were found. When the colon bacillus is the infecting organism it is often found in the urine in pure culture.

The direct examination of the inflamed bladder gives the surest information as to the existence of the disease, its grade, and its extent.

The knee-chest position is the most convenient one for seeing all parts of the organ, but in milder grades of cystitis the artificial anemia induced by the posture and expansion tends to obliterate the characteristic signs; it is better, therefore, in these cases to examine in the dorsal position with a slight elevation. The patient should be put under anesthesia for the first investigation. so that it may be thoroughly made. The inspection begins at the posterior wall, and extends in an orderly manner over the whole organ, as described.

In this class of cases one is apt to find a superficial layer of blood on the mucosa at the posterior pole arising from the trauma occasioned by the end of the speculum impinging on the inflamed delicate mucosa. The difference between this and the submucous hemorrhage can be detected by wiping the surface with a pledget of cotton, when the blood comes off. The affected areas are rendered strikingly apparent by contrasting the normal whitish background and the deeply injected patches of inflamed tissue. In the sound parts the capillaries are rarely seen, and the pale mucosa is mapped out by larger branching vessels, but the diseased areas show a fine capillary network, or else capillaries so numerous that a general red color of varying intensity prevails.

By the bimanual examination the bladder is found tender to touch, and when the muscular coat is thickened it may feel like a tumor behind the symphysis. In one of my cases I found a hard ovoid mass as big as a hen's egg lying transversely in front of the uterus; this proved to be a tubercular bladder in the last stages of the disease. (Fig. 272.)

General Treatment.—The treatment of a cystitis will vary widely, according to the cause and character of the inflammation. When there is a continuously acting cause, such as a stone in the bladder, or urine pouring out of an infected kidney, or a stagnation of the urine in an imperfectly emptied bladder, these conditions must be relieved before any progress can be made toward a cure. As a rule, it is sufficient to remove the cause to effect a cure, and this will be done in the instances cited by lithotomy, or by nephrectomy, or by nephro-ureterectomy when the ureter is involved too, or by relieving a prolapsus of the uterus and the bladder, and washing out the stagnant urine two or three times daily with warm boric acid solutions (2 to 3 per cent).

Prophylaxis is of the utmost importance in the prevention of cystitis. By the exercise of due prophylactic care some of the worst cases could be prevented. None but an intelligent, well-instructed nurse ought to catheterize a puerperal woman. Every time the bladder is catheterized, the external urethral orifice and its surrounding parts ought to be carefully cleansed and after this an aseptic catheter should be used. The bladder must also not be allowed to become overdistended. If this occurs and repeated catheterizations are necessary, cystitis, sometimes in a very troublesome form, is apt to occur. Where such repeated catheterizations are necessary, it is best to irrigate the bladder each time with a warm boric acid solution, and to give small doses of urotropin, say about three grains every four hours.

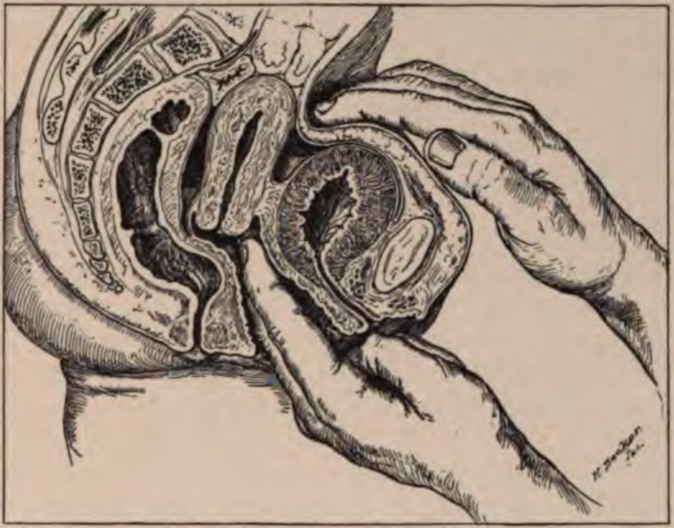


FIG. 272.—TUBERCULAR CYSTITIS.

Shows the markedly thickened vesical walls and the method of palpating the bladder bimanually.

Treatment of Acute Cystitis.—An expectant palliative plan of treatment should be pursued in acute cases; under these circumstances local treatment or interference of any sort aggravates the intensity of the inflammation. The patient must stay in bed in a warm room, the bowels be kept open, and the diet reduced to liquids and soft food; all stimulants must be prohibited. Prolonged hot vaginal douches, lasting fifteen to twenty minutes, given three times daily, help to relieve the congestion; hot applications should be kept on the lower abdomen, if they give comfort. Hot sitz baths and dry hot bran bags are also valuable adjuvants.

While the pain is excessive and persistent it is necessary to give the patient as much relief as possible, and to insure some hours of rest and sleep every day.

Morphin meets this indication better than any other drug, and the best way to use it is to give enough of it hypodermically in two or three doses to secure about eight hours of continuous rest. During the remaining sixteen hours codeia may be tried, and hyoscyamus and belladonna should be given in suppositories, or an occasional rectal enema of 30 drops of deodorized tincture of opium in 100 to 120 c.c. of warm starch water.

Urotropin in five to ten grain doses, repeated three or four times a day, is a valuable adjuvant. It works most efficiently in recent cases of colon bacillus infection.

As soon as the inflammation begins to subside, as shown by the lessened pain and frequency of micturition, the convalescence will be greatly promoted by washing out the bladder two or three times daily with lukewarm water containing 2 per cent of boric acid or 2 per cent of ichthyol.

Treatment of Chronic Cystitis.—The treatment of chronic cystitis must always be one of active interference. Four plans of attack are available: (a) Medication, (b) irrigation or instillation, (c) direct topical treatment, (d) surgical treatment.

Medication.—A great variety of drugs have been recommended as beneficial in curing or relieving chronic cystitis; there is a large amount of trustworthy testimony in favor of salol in doses of from 3 to 5 grams daily in divided doses; under its use the symptoms abate, and the bacteria in the urine diminish in numbers. Quinin, which is largely eliminated by the kidneys, has a sedative effect on the urinary organs, and is said to act effectively in sterilizing the urine. Salicylate of soda in a 5 to 10 gram dose is also used in some cases with good effect.

Urotropin in three to five grain doses, given three to four times daily, ought to be administered in every case, as an adjunct to whatever form of treatment may be used. Freudenberg recommends small doses of cantharadin (Merck) 0.001 in 1.0 alcohol dissolved in 100 water. This is taken in teaspoonful doses three to four times a day.

It is of advantage for the patient to drink water freely, accustoming herself even to the imbition of two to three quarts daily.

In the rarer gonorrheal cases, oil of sandalwood or oil of copaiba in capsules, 5 to 10 minims each, give excellent results. Eucalyptus oil has also been found useful in 10 minim doses every two hours. Fluid extract of zea maïs (cornsilk), in half teaspoonful doses, is the best drug I know to allay the irritability of the bladder; fluid extract of triticum repens is used in the same way.

A milk diet is of the best service in many cases.

Irrigation.—Irrigation, or washing the bladder out, is a necessary adjuvant to other means of treatment; by this means the bladder is thoroughly cleansed, and enormous numbers of bacteria removed, with mucus and other *débris*, often imperfectly discharged in micturition, and, for a time at least, the bladder walls are relieved from the constant contact with toxic products.

The irrigation may be carried out in two ways: either by letting small quantities of the fluid run in and directly out again, or by injecting larger quantities, so as to distend the bladder sensibly, and then, after an interval of from a few seconds to a minute, letting it flow out again. The latter plan has the advantage of distending the bladder so that its entire mucous surface is cleansed by coming into contact with the solution. The amount of discomfort experienced by the patient should serve as a guide as to the amount of distention to be practiced at each sitting, and with repeated trials it will be found that the bladder grows more tolerant. I cannot too strongly insist upon the value of these distention treatments, which are to be carried out by insisting from week to week upon the retention of more and more fluid by the bladder until finally it holds 200, 300, 500, or more c.c. The first steps in the distention treatment, by which a toleration of 20, 30, or 40 c.c. is assured, are always the most difficult. A gentle, patient persistence, however, never discouraged by failures almost always secures the end in view. One great value of these treatments, even when they do not effect a cure, is the fact that they serve to ameliorate and eliminate the more recent acute areas of inflammation and to reduce the disease to, perhaps, one or two areas of ulceration of moderate size, which can then be treated by excision. The irrigating solution is apt to give pain if its specific gravity is much below that of the urine; for this reason plain warm water, although useful mechanically, is not well tolerated.

A satisfactory solution (see A. S. Lobingier, *Medical News*, Philadelphia, Oct. 15, 1892, p. 425) is made with a powder of boric acid, borax, and chloride of soda in the respective proportions of 4, 2, and 1 grams dissolved in half a liter of hot water, and used warm.

Solutions of the bichloride of mercury have a bactericidal effect and are of the utmost service in most cases of chronic cystitis. It is best to begin using weak solutions of 1–100,000 in water in which a little common salt has been added (.6 per cent), increasing the strength of the solutions each time until they are used as strong as 1–10,000 or 1–5,000. It is well to vary these irrigations with the milder boric acid solutions, using them on alternate days, or one in the morning and the other in the evening.

Weak solutions of carbolic acid, not stronger than 1½ per cent, often do good service. When the distressing symptoms have cleared up and the urine still remains purulent, Mr. Nunn (*Lancet*, Feb. 23, 1878) recommends the use of a quinin wash, beginning with one grain of the neutral sulphate to the ounce of water, with one drop of muriatic acid.

When the urine remains alkaline and there is a tendency to throw down phosphates, Mr. R. Harrison (*Twentieth Century Practice*, vol. i, p. 239) recommends irrigation with 5 to 10 grains of citric acid dissolved in a pint of warm water.

The technique of the irrigation is as follows: The patient is put on a table, or if she is too weak she is brought to the edge of the bed with the thighs flexed and the buttocks resting on a perineal drainage pad; the parts are then freely washed with a weak boric acid solution, particular care being taken to remove all visible foreign material from the urethral orifice.

As an irrigating apparatus I use a simple glass funnel connected with a glass catheter by a piece of rubber tubing four feet long. A clip or a pair of forceps on the tubing controls the flow of the fluid. Unless the person giving the injection can be relied upon to do it skillfully, it is better to use a rubber catheter in place of a glass one, which may bruise the tissues.

The solution is now poured into the funnel, and allowed to run down and fill the tube and catheter; the injection of any air must be avoided, because it is painful. The catheter is then introduced into the bladder and the funnel held high enough to force the fluid slowly into the bladder; after waiting a while the funnel is now dropped below the level of the table and the fluid flows back again. If the solution is comparatively clear the maneuver may be repeated, but as often as it becomes turbid it should be renewed. Irrigation may also be practiced through a two-way catheter, such as that shown in the text (see Fig. 273); the fluid runs in the upper arm in the direction of the arrow and returns by the lower.

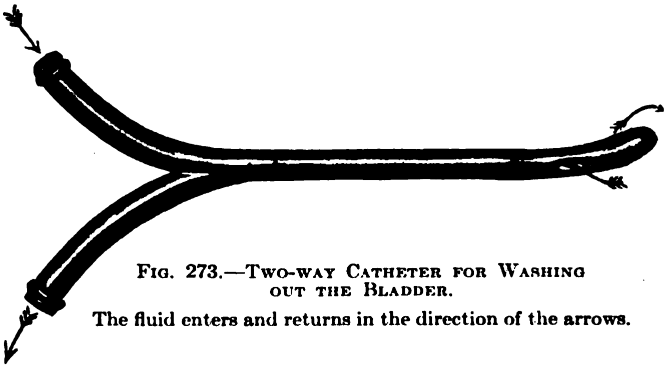


FIG. 273.—TWO-WAY CATHETER FOR WASHING OUT THE BLADDER.

The fluid enters and returns in the direction of the arrows.

Instillation.—Instillation differs from irrigation in that the medicated solution is injected in smaller quantities and is left in the bladder for a time, in order to secure a more protracted action on the bladder walls. In this way solutions of nitrate of silver (1 to 2 per cent), sublimate solutions, and iodoform emulsions (5 to 10 per cent) have been used.

Instillations have been systematically used with excellent results by M. Guyon, of Paris. Small quantities of fluid have been used, in accordance with Guyon's dictum that the bladder does not possess an anatomical but a physiological capacity, and a painful bladder must not be distended. Solutions of the bichloride of mercury are used, in a strength varying from 1–4,000 to 1–500, beginning with the weaker and gradually increasing up to the stronger solutions, and injecting at first every other day and then every day as the patient's tolerance is tested. A syringe is used holding about 5 grams (1¼ drachms), and from 2 to 5 grams are injected slowly into the bladder and allowed to remain there from fifteen minutes to half an hour. The treatments must be continued for a period varying from some days to several weeks. Out of 34 cases so treated, 12 were cured, 9 were very greatly improved, 9 improved, and 4 unimproved.

Direct Topical Treatment.—By far the most efficient way of treating chronic cystitis is by direct topical applications, which, however, should not entirely supersede the use of internal medication or of irrigations and instillations.

There are two ways of treating the affected areas directly: either by exposing them to view and then applying a medicated solution, or by using a rubber balloon, which is inflated in the bladder so as to distend its walls and bring every point of its mucosa into contact with a medicated substance.

The first plan, of exposing and treating the diseased patches, is best in old chronic cases where the patches are few in number and do not cover much surface. It is done in the same way and with the same ease with which the bladder is inspected. The patient is put in the knee-chest position and the vesical speculum introduced, the air-distended bladder inspected, and the extent of the disease accurately determined and mapped out on a diagram for future comparison. The application is then made under direct inspection by means of a pledget of cotton twisted on a wire applicator, care being taken to touch nothing but the diseased spots. This is easy if the parts are kept under view, and if the cotton is not too wet with the solution. The amount of surface treated at one time must be regulated by the kind of application made, and by the extent of the disease. It is also well to proceed cautiously at first by trying any of the stronger stimulating drugs on a limited area and watching the effect. I often use at first a 5 per cent solution of nitrate of silver, following it up by a 3 per cent solution every four to five days. If the mucosa is acutely inflamed at any point these solutions must not be applied.

Surgical Treatment of Chronic Cystitis.—In obstinate cases associated with great pain, relief has often been given by making an opening in the base of the bladder so as to let the urine escape into the vagina, keeping the bladder empty and giving it a complete physiological rest for a period of several months or longer until the cystitis is cured. This procedure has had a warm advocate in Dr. T. A. Emmet, who has repeatedly employed it with success. (See "Chronic Cystitis in the Female," *Amer. Practitioner*, Feb., 1872.)

But as the constant dribbling of the urine through such an artificial fistula entails all the distressing disagreeable consequences of a fistula from any other cause, it is to be expected that the field for this operation will be limited to the cases not relieved by the direct plans of treatment just described.

The operation is done in the following manner: The patient is put in the dorsal position with flexed thighs, a sound is introduced into the bladder which is distended with water, and the base of the bladder well behind the urethra is pushed forward into the vagina into the median line on the end of the sound. The anterior vaginal wall being well exposed by retractors, the operator cuts through the vesico-vaginal septum onto the sound with a narrow-bladed knife; a gush of water shows that the bladder is opened and the sound passes through into the vagina. As the water escapes, the hole is quickly enlarged backward until it is at least 2 cm. long.

In cases of advanced cystitis, where almost the entire bladder is involved, and where there are areas of ulceration, I find it is best to begin the treatment by draining the bladder for some weeks, and by keeping the patient for several hours daily in a tub of warm water at a temperature of about 38° to 39° C. (100° to 102° F.). When the patient is sufficiently prepared for operation the bladder is emptied and she is put into the knee-chest position. A catheter is next introduced, allowing the air to rush in and stretch the bladder to a maximum. An assistant then lifts up the posterior vaginal wall so as to expose the stretched anterior vaginal wall with the cervix uteri at maximum distance. The operator then takes in hand the knife attached at an angle to a handle which is also bent, as shown in the figure. He plunges this knife through the vesico-vaginal septum in the median line, at a point about 1½ cm. in front of the cervix (see Fig. 274). In this way the bladder is opened, and, by drawing the knife down toward the urethra, the incision is made any length which may be desired. By putting the finger in the incision into the bladder, the internal orifice of the urethra is located and the knife safely guided as far forward as it is desirable to cut. The operation may be done without any anesthetic at all, or by injecting a weak solution of cocain into the vesico-vaginal septum. There may be little or no bleeding attendant on it, on account of the posture of the patient. When it is desirable to secure drainage for a short time in a dependent position, and also in cases of irritable

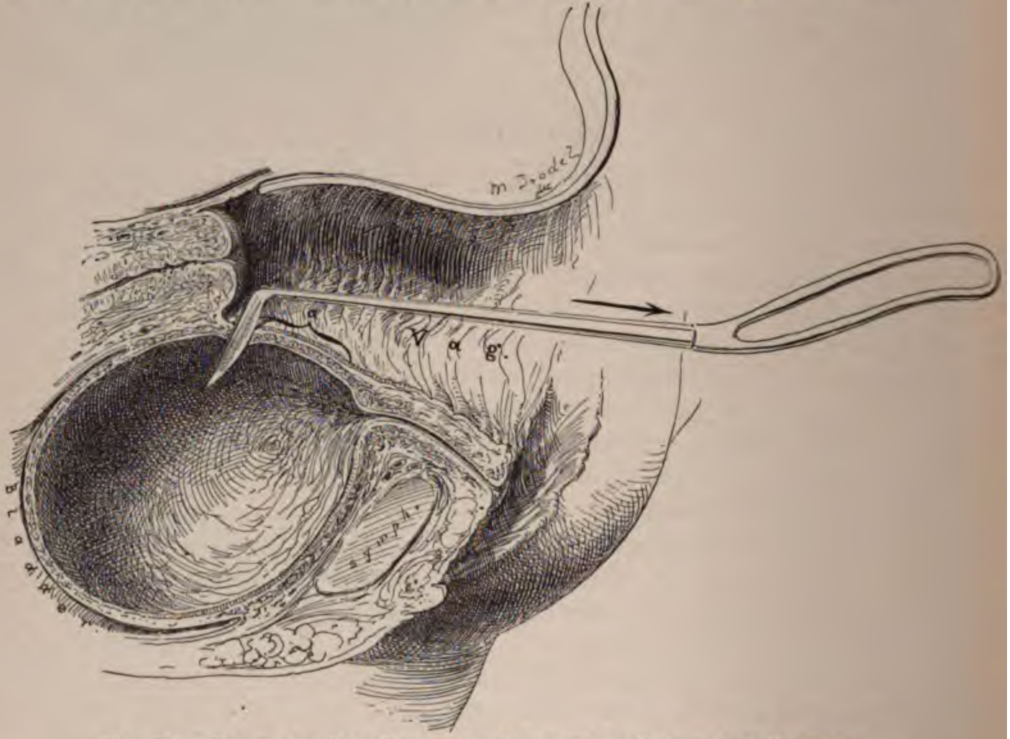


FIG. 274.—RAPID AND SAFE METHOD OF OPENING THE BASE OF THE BLADDER.

The patient is in the knee-chest posture. A speculum is introduced to admit air into the bladder. The air-distended organ is then opened in the manner seen in the figure to the extent indicated at *a*.

urethra, I plunge the knife through the septum into the air-distended bladder, midway between cervix and urethra, making a hole about a centimeter in size, through which I introduce a mushroom catheter, which is left *in situ* for a week or ten days. As soon as the catheter is withdrawn the wound heals spontaneously. This method of drainage is also of great advantage in operations about the urethra. This posture and this method of incising the vesico-vaginal septum are also superior to any method of opening the bladder for the removal of a vesical calculus. As soon as the stone is removed, the incision may be closed up with the utmost ease and accuracy, the patient being still in the same position (see p. 412). (*Amer. Jour. Obst.*, 1901, vol. xliv, p. 66: "A New and Better Method of Opening and Draining the Bladder in Women.") In order to insure the permancy of the opening the vesical mucosa must be drawn over the intervening cut surface of the septum and attached to the vaginal mucosa on all sides by a continuous catgut suture; this prevents the fistula from closing spontaneously, as it would do if raw surfaces were left exposed and in contact. In a tight virginal orifice, the opening must be cut down either in the median line or laterally, and the vaginal mucosa stitched to the perineum, in order to prevent the retention of large quantities of urine in the vesico-vaginal cloaca. While the patient is still in the same posture the vesical mucosa should be stitched to the vaginal, so as to prevent the rapid closure of the opening. The vagina should be irrigated daily, and the external parts protected by a stiff zinc-oxide ointment. Clean gauze pads must be kept under the patient at night and fresh ones applied often by day. When the inflammation has subsided, in the course of several months, then the edges of the fistula should be pared and the opening closed.

Excision.—When a cystitis has proven rebellious to other plans of treatment and the disease is localized, even if it occupies as much as a third or more of the bladder, excision offers a valuable means of the eradiction. This is described more fully in the next section.

Various Forms of Cystitis.

Tubercular Cystitis.—Tubercular disease of the bladder in women is observed with a frequency which increases just in proportion as careful direct examinations of the bladder and bacteriological investigations of the urine are made. It either exists primarily in the bladder or descends from the kidney to the bladder, or it may be a part of a general tuberculosis.

With but few exceptions tubercular disease of the bladder is a descending disease, etiologically dependent upon a tubercular kidney above. In these cases the tubercular vesical process is usually most marked in the neighborhood of the ureteral orifice of that side from which the infection comes. Areas of ulceration are seen around the ureteral mons and the orifice is puffy and edematous, often with pendant bits of translucent tissue. I have had one case of tuberculosis of the bladder with a deeply injected right ureteral orifice and a golf-hole orifice, in which I exposed and incised both kidneys from upper pole to lower pole, even into the pelvis, and yet found no tubercular disease there. The bladder affection was cleared up by drainage and local treatments and the patient has regained perfect health.

R. Ultzmann ("Die Krank. der Harnblase," Stuttgart, 1890, p. 151) states that tubercular cystitis often complicates other inflammatory processes, and more especially those due to gonorrhea, when the gonococci may be found in close association with tubercle bacilli.

T. Rovsing ("Die Blasenentzündungen," etc., Berlin, 1890) declares that tubercle bacilli can not engender a tubercular cystitis in a sound bladder, not even when there is a retention of urine, but that a direct inoculation into the mucosa, or a preliminary suppurative cystitis are necessary factors.

The disease is not often seen in its initial stages, at which period there is simply an intense catarrhal condition of the bladder. In cases of infection from a tubercular kidney, or a tubercular abscess behind the broad ligament discharging into the bladder, the infection is most marked in a path in front of the ureteral orifice of that side, or in front of the sinus opening into the abscess, where infected urine meets the mucosa before dilution. In addition to the catarrhal cystitis found here, there are often numerous little scattered whitish nodules having the appearance of tubercles. Sooner or later caseation occurs and the tubercles break down, leaving a deep ragged-edged ulcer; the urine then contains pus, mucus, and blood.

The tubercular ulcer or ulcers may advance but slowly; in the worst cases the entire bladder is involved, and the bloody urine is constantly expelled in small quantities with great suffering. The trigonum, the base, and the posterior walls are oftenest affected. If the disease is left to run its natural course it is always chronic, extending over a period of many years with slow changes. In a more intense form, when the entire bladder participates in the disease, it may terminate fatally in a few months or a year.

The family history may give the right clue to an obscure obstinate form of cystitis, as in the following case occurring in the practice of the late Dr. L. M. Sweetnam, of Toronto:

The patient, a young woman twenty-three years old, began to have severe pain in the urethra, and died eleven months after the onset of an extensive tuberculosis involving the bladder, the urethra, and the right ureter and kidney; the temperature at one time reached 108° F. In the same family twin sisters died of pulmonary tuberculosis; another sister had tubercular glands in the neck four months after the extraction of some teeth; a fourth sister lost one eye and a nasal bone, and had five or six tuberculous skin lesions, a spina ventosa affecting three metacarpal bones, and a tubercular tarsus. A brother, twelve years old, and both parents were healthy. In four cases of tuberculosis of the bladder reported by Dr. Edward Reynolds (*American Medico-Surgical Bulletin*, April 4, 1896) the family history was negative in two and distinctly tubercular in two.

Diagnosis.—A cystitis occurring in a phthisical patient not exposed to gonorrhea is most likely tubercular, too. All cases of cystitis in young persons are open to this suspicion if they are clearly not gonorrheal. S. Bontor (*British Med. Jour.*, 1893, vol. i, p. 1058) reports a case of a tubercular ulcer over the left ureteral orifice in the bladder of a child five years old. Chronic ulcers found in the bladder are usually tubercular.

The diagnosis is made certain by finding the tubercle bacilli either in the urine or in the tissues themselves. When the disease is advanced the bacilli can usually be found in large numbers without any trouble, but in other cases repeated examinations must be made to find even a few of them. The surest way to find the bacilli and so clear up the diagnosis is to expose the diseased area and curette off a little piece of the tissue from the margin of the ulcer; the microscopic examination of this may show the presence of the bacilli when they have been sought in vain in the urine.

In Reynolds' four cases there were a few isolated papules discovered in each case. They were about the size of a grain of rice, slightly oblong, glistening, rounded, and elevated above the surface of the mucous membrane. These papules were carefully watched, and were found to break down and form tubercular ulcers.

The tubercular ulcer is characterized by a granulating base, with sharp, irregular edges, and small hemorrhagic foci surrounding it. In the most advanced cases the contracted bladder simply appears as a mass of ulcerations with irregular surfaces filled with pus, blood, and mucus. When the disease descends from the kidney, the part first affected is that about the ureteral orifice of the affected side.

E. H. Fenwick (*Lancet*, 1891, p. 935) injected tuberculin in a patient with a tubercular ulcer with the result of bringing on a violent attack of hematuria; others have used the injections with negative results.

Treatment.—The outlook in a case of tuberculosis of the bladder from a therapeutic standpoint is no longer so hopeless as it was before the use of the endoscope. We are able with our present diagnostic methods not only to determine the specific nature of this disease, but to discriminate between the extensive cases and those which remain localized and are more amenable to treatment.

In all these cases the general health demands the most painstaking attention; associated with rest, abundant nutritious food, suitable exercise in the fresh air, and it may be change of climate and scene, we must also depend largely upon such medical agents as cod-liver oil, iron preparations, and other tonics which have been found useful in combating tubercular processes of all kinds.

When the bladder disease forms but a part of a more general infection, or is associated with an extensive lung affection, but little will be accomplished locally in staying the progress of the affection. If the disease is in some neighboring organ, as in a kidney or a uterine tube, and the bladder is only secondarily involved, the original focus must be removed before any results may be expected from the treatment of the bladder, and if the disease is but limited, it may clear up without further assistance.

The direct treatment of a tubercular bladder is either by injection, by topical applications, or by surgery.

As injections, iodoform emulsions (5 to 10 per cent), solutions of corrosive sublimate (from 1–5,000 to 1–500), nitrate of silver (1½ to 2 per cent), and lactic acid (5 per cent solution with cocain) have been used; good results are to be looked for from the use of iodoform made into an emulsion (5 to 10 per cent) with glycerin, gum acacia, and water. This should be injected into the bladder. Such treatments continued every two or three days are calculated to yield the maximum effect of local treatment. By the instillation methods above described Guyon has been able out of sixteen cases of tubercular cystitis to cure three, to improve six greatly, and to induce some improvement in five.

A case of vesical tuberculosis reported by Dr. J. O. Polak, of Brooklyn (*Amer. Gyn. and Obs. Jour.*, January, 1897, p. 41), is a model of clear description and effective treatment.

The patient, an unmarried Swedish girl, twenty years old, during an attack of anemia three years before, began to suffer sharp lancinating pains on urination; she lost weight and had frequent hematuria. In the latter part of April, 1896, she had an unusual vesical hemorrhage with inability to void the urine and a constant intense tenesmus; several ounces of bloody urine were drawn by catheter drop by drop. The temperature was 102° F., and the pulse 120. On palpation, there was exquisite tenderness all over the region of the bladder and blood dripped from the urethra.

By means of a large cystoscope the bladder was found filled with clots of blood; after washing and sponging them out, an ulcerated area, about 3 cm. in diameter, was detected on the right side of the bladder near the neck, it had raised irregular edges and was studded with tubercles; the remaining mucosa was normal. This patch was thoroughly curetted through a cystoscope, and vesical drainage established by a coil of gauze enclosed in gutta-percha tissue.

Three days later the urine still contained pus, blood, and tubercle bacilli. Daily vesical irrigations were used, and a 50 per cent emulsion of iodoform injected after each one.

May 15: A direct examination revealed an area of ulceration with pale, flabby granulations, which appeared as though varnished with a thin coat of serum. A solution of nitrate of silver (80 grains to the ounce) was carefully applied to the dried surface of the ulcer, followed by a daily irrigation with a solution of salicylate of soda. Prompt improvement followed, the bacilli steadily diminished in numbers, and by June 1st the urine was normal.

June 10: By direct cystoscopy a normal mucous membrane was seen, and the place of the ulceration was occupied by a pale cicatrix. After this the patient gained twenty-five pounds in weight.

October 15: No recurrence of symptoms.

Petit ("Injec. contre la tuberculose de la vessie," *Semaine méd.*, 1892, t. xii, p. 42 [annexes]) uses an emulsion consisting of iodoform, 20 grams, glycerin, 10 grams, and water, 6 grams, with gum tragacanth, 0.25 grams. A teaspoonful of this mixture is added to 150 grams of warm water with 10 drops of laudanum, and the whole is injected slowly into the bladder; half the quantity is allowed to run out in two minutes and the rest to remain as long as possible.

Topical Applications.—The means we now have of exposing the tubercular ulcer and of making direct applications to its surface opens up an entirely new field for therapeutic research, since we shall be able to apply concentrated solutions to the diseased spots without risk of injuring the sound mucosa elsewhere. After making such an application the bladder may be filled with water and washed out repeatedly. Varying strengths of silver nitrate from a 20 per cent aqueous solution to the solid stick applied in this way have proved of great value in Reynolds' hands.

The surgical treatment of such an obstinate affection will prove the most satisfactory way of dealing with it in selected cases where the disease is localized and does not respond to simpler methods. The various surgical methods are curettage, cautery, and excision.

Curettage of the Bladder.—Curettage has been successfully practiced by Guyon and others in cases of rebellious cystitis and for tubercular cystitis. Curettage is an eminently rational plan of treatment for two reasons: In the first place the lesions of both forms of cystitis are as a rule localized in the more superficial parts of the bladder in the mucosa, and hence easily removed without risk, and in the second place the regeneration of the mucosa, even after an extensive destruction, takes place readily.

The procedure is conducted in this way: A sharp curette is used, the patient placed in the lithotomy position, the bladder thoroughly washed out with a mild antiseptic solution and emptied. The finger is then inserted into the vagina and the curette directed through the urethra into the bladder, where it is first employed in curetting the base of that organ, using the finger as a point of counter-pressure; at the same time the amount of force employed can be readily estimated; the curette is next used over the vesical surface behind the symphysis pubis. After cleansing out the bladder the curette is again introduced, and the posterior lateral and superior portions are next attacked. Such is the procedure in the rare cases in which an aggravated cystitis has gone so far as to involve the entire vesical mucosa; by making a careful cystoscopic examination beforehand, those cases, in which the lesions are localized in certain areas of the bladder, will also be recognized, and the curettage will then of course be directed only against the diseased portions, sparing the sound tissues any unnecessary insult.

It is now easy to use the galvano-cautery through the cystoscope in the air-distended bladder, and to continue its use from time to time so as to test the efficiency of this mode of treatment.

Excision.—The ideal mode of treatment of a tubercular ulcer, which is not relieved by the simpler plans just detailed, is its exposure and excision, followed by suture. This is easily practicable through a longitudinal suprapubic incision without opening the peritoneum. The best way to expose the bladder extraperitoneally is first to distend it with air in the knee-chest posture. By this means the peritoneum is pushed up so far that on cutting down through the fascia just above the symphysis, the bladder appears as an ovoid organ about the size of a small fist. In case an extensive exsection is necessary, the entire organ down to its base in front and at the sides is easily dissected out and isolated. It is well before incising the vesical wall to detach the fat and connective tissue enveloping it. It is better to remove old ulcerated areas by cutting through the entire thickness of the bladder walls when this is feasible. The bladder is incised parallel to the abdominal wound, and its edges temporarily stitched to the skin surface to keep it from dropping out of easy reach during the operation; then in the more superficial cases of the disease the mucosa may be extensively excised, being cut through a short distance from the affected edges and detached by a blunt dissection. Any little patches of sound mucosa must be carefully left, as they will materially aid in the rejuvenation of the mucosa, acting like grafts on the skin surface. R. Bardenheuer (*Centralbl. f. Gynäkol.*, 1894, Bd. xviii, p. 336) has even excised the entire mucosa without interfering seriously with the bladder function. It is a question whether in such cases the new mucosa grows out from the urethral and ureteral orifices, or is reproduced from minute portions left in numerous little depressions. When the disease extends deeply into the vesical walls, the tubercular area must be cut out, and the edges then brought together by interrupted catgut sutures, as in the treatment of a vesico-vaginal fistula.

When the tubercular area is about one of the ureteral orifices, the operator must determine whether the upper urinary tract of that side is affected; if it is not, the area may be excised and the ureter turned into the bladder at a point farther back.

It will be best in these cases not to leave a suprapubic drainage opening. The incision into the bladder through which the operation has been conducted should be sewed up independently of the abdominal incision, by using a series of interrupted catgut sutures, or, better still, sutures of fine silk, about four to the centimeter, catching only the muscular walls. The abdominal incision should be closed by interrupted silkworm gut or silver wire sutures, leaving room for a tiny drain; the bladder should be drained through the urethra for five or six days.

If the sutures tend to come away through the bladder, they may be exposed, cut, and taken out through a No. 12 or 14 vesical speculum.

Exfoliative Cystitis.—The expulsion of a part or of the whole of the mucous membrane of the bladder sometimes occurs as a form of cystitis (cystitis exfoliativa). This is a disease to which women are peculiarly liable, although it is also, rarely, seen in men.

There is a clear and excellent account of a case in Nicholas Tulp's "Observationes medicae" (Amst., 1762, lib. 2, cap. xlviii), under the title membrana lapidescens (membrane turning into stone). Gerbreghta Rotaria, thought to have a calculus, finally passed a large membrane covered with little stones and with a perforation in the middle, so that the urine could escape through it. But some pieces of the membrane remained behind, and until nature freed her from them, she suffered excessively. The fibers of the bladder being relaxed, there was an involuntary escape of the urine, which was finally relieved by tissue-strengthening medicines.

The causes of such a detachment of the mucous membrane are various, the commonest being retroflexion of the gravid uterus, which is found in 50 per cent or more of the cases; other causes are protracted birth (25 to 30 per cent), the pressure made by a myoma choking the pelvis (see A. Gottberg, *Inaug. Dis.*, Kiel, 1892, and Fr. Vahle, *Inaug. Dis.*, Marburg, 1895), retention of urine, and in one case the injection of a strong saline solution into the bladder (Begouin, *Jour. de méd de Bordeaux*, t. xxii, p. 158).

The common factor underlying all the various causes is probably the ischemia produced by pressure, for the cutting off or lessening of the vesical blood supply results in an ischemic necrosis, with or without an infection.

The detached membrane may be extruded entire or in small pieces; the mucous surface may be so altered by the necrotic changes that it is recognizable with difficulty, and its surface is often studded with uric acid crystals. Adhering to it are often found more or less extensive portions of the muscular coat, and in the worst cases the peritoneal coat is also involved; in this way three grades of the affection are established (H. Boldt, "Suppurative Exfoliative Cystitis," *Amer. Jour. of Obstet.*, vol. xxi, 1888, p. 361).

H. S. Cocram reports a case of a woman four months pregnant (*Medical News*, Phila., vol. lxiii, p. 633) in which the bladder was distended to within an inch of the ensiform cartilage, where the entire mucosa became detached and was expelled, and the openings for the ureteral orifices could be seen in it. The patient was able to leave the hospital in twenty days, and recovered completely.

The clinical history shows frequent micturition and overdistention of the bladder, often with dribbling, associated with a retroflexion of the gravid uterus, or a pelvic tumor, or else following a difficult childbirth. Schabert reports a case (*St. Petersburg med. Woch.*, Bd. xix, p. 373) following the birth of twins. The bladder becomes exceedingly tender, and there is an acceleration of the pulse with fever, together with all the disturbances usually associated with a severe septic process.

In a case of my own, where an overdistention of the bladder followed ovariotomy, portions of the mucosa were cast off, the patient had a high fever and became insane; she was put into an asylum where she died more than a year later from pulmonary phthisis.

The urine, at first turbid, becomes fetid, and in a few days pieces of the membrane are expelled; when the membrane becomes detached and endeavors to escape entire, it may block the internal urethral orifice for a time, causing a renewed retention of the urine. Its expulsion may be brought about with great pain and straining, and after this there is a more or less permanent dribbling of the urine. In some cases, the bladder regains its function in time to an unexpected degree; in others it is never able to hold more than a little urine at a time.

Death may occur from sepsis, or from one of the complicating conditions, such as peritonitis, or pyelitis from an upward extension of the infection, or later from uremia.

The diagnosis is made by recalling the clinical history of the case, associated with a cystitis and discharge of the vesical tissue. On examining the base of the bladder by the vagina, it is found thickened and tender, and in cases where the loosened tissue obstructs the urethra, the catheter may perforate this and let out a lot of foul urine from behind it. The difference between these septic cases with such a history, and the prolapse of the vesical mucosa occurring mostly in children, is so marked as to need reference only.

The treatment must first be directed to the condition which causes the retention, if it is still active, and, secondly, to the condition of the bladder itself. If the uterus is retroflexed and incarcerated, the patient must be put under an anesthetic, if necessary, in order to reduce the flexion, when it may be kept in place by an appropriate vaginal pack.

If the pelvis is choked by a myoma, an effort should be made to dislodge it into the abdomen. If this can not be done, it will scarcely be advisable to open the abdomen and remove the tumor until the vesical symptoms have subsided.

The bladder itself must be carefully watched to prevent any large accumulation of urine in it, and when the membrane is in the process of detachment and expulsion it is best to assist nature by gentle traction, and cutting off any protruding portions. If the membrane chokes the urethra and prevents the escape of urine, the accumulation will be voided by passing a glass catheter through it.

After the early acute symptoms have passed off, the patient will be greatly benefited by washing out the bladder two or three times daily, using a warm boric acid solution, and the irrigation must be kept up as long as pus and bacteria are present in the urine.

TUMORS OF THE BLADDER.

A variety of tumors is found in the bladder in women, but they are not so frequent in men, the proportion being about one to three or four. They may be grouped according to their clinical significance—that is, their tendency to remain localized or to invade the surrounding tissues, as benign and malignant (see G. Clado, " Traité des tumeurs de la vessie," Paris, 1895, p. 63).

1. The benign tumors are papilloma, fibroma, adenoma, myoma, and dermoid cyst.

2. The malignant tumors are carcinoma and sarcoma.

The malignant group further includes all forms of tumors of a mixed nature, except fibro-myoma, and all forms of degenerated tumors.

If we bear in mind the several component tissues of the bladder walls—the mucosa, submucosa, and the muscular layer—and examine the various neoplasms found there from the standpoint of origin, they may be classified as follows (Küster, *Sam. klin. Vortr.*, 1886):

1. Connective tissue tumors of the mucosa and of the submucosa: Papilloma and fibroid polyp, mucous polyp, sarcoma.
2. Tumors of the muscular tissue: Myoma.
3. Tumors of the glandular tissue and epithelium: Adenoma, epithelioma.

Tumors are furthermore primary when they originate in the bladder, and secondary when they extend to the bladder from other organs. The secondary tumors are naturally of the malignant type; the commonest form is carcinoma of the cervix uteri which advances to the bladder.

Nothing whatever is known as to the etiology of primary vesical tumors. J. Albarran ("Les tumeurs de la vessie," Paris, 1892) is of opinion that the chronic irritation produced by the presence of micro-organisms is an efficient cause.

The villous outgrowths covering the interior of the bladder (vesica villosa), in some cases associated with calculus, are undoubtedly the product of mechanical irritation, but these can scarcely be called neoplasms in the strict sense of the word.

Clado has shown that the normal bladder contains villi, which throws light on the frequent association of villous outgrowths with all variety of bladder tumors.

Secondary tumors of the bladder are not usually metastatic in the ordinary sense, but invade it by contiguity of tissue. In men, most of these tumors are furnished by the prostate and the rectum, and in women the enormous frequency of cancer of the cervix uteri is the occasion of the frequent involvement of the base of the bladder. I have seen the most extensive sarcoma of the genital system from the vagina through the uterus and out onto the peritoneum, without any bladder affection.

The seat of vesical tumors is found more frequently in certain areas than in others. The places of predilection are exhibited in Féré's table, where, out of 107 cases, there were in the base of the bladder alone, 25; attached to both base and the walls together, 13; on the posterior wall, 17; close to the right ureter, 5; close to the left ureter, 8; anterior wall, 2; anterior and superior wall, 1; right or left lateral walls, 4; multiple tumors, 12; diffuse tumors, 8, etc.

Out of 634 cases of polypi, Fenwick (*British Medical Journal*, 1888, vol. ii, p. 666) found that the tumors were single in 60 per cent and multiple in the remaining 40 per cent.

Albarran (*ut supra*, page 61), in an analysis of 82 cases, found that the tumors were single in 61 and multiple in 21 of the cases, a proportion of about 75 per cent.

One of the most important statistical subdivisions of these tumors, from a clinical and a therapeutic standpoint, is that which is based on the nature of the attachment of the neoplasm to the vesical walls. Albarran (*ut supra*, page 53) found in seventy-eight personal observations of tumors of the epithelial type (in which are included all the commoner forms—the papillomata, cysts, adenomata, and epitheliomata) that they were attached as follows: Pedunculate, 28; sessile, 9; encephaloid (infiltrating), 31; cancroid (mammillated, bossed, ulcerated), 10.

No two writers are precisely agreed in their classification of these tumors, and in many of the reported instances the diagnosis has been made purely from the macroscopic appearances, which accounts for the enormous preponderance of tumors described as "papillomata," a term that really includes fibroid, adenoid, and malignant epithelial growths. Although it is true that a benign growth may exist in the same bladder with a malignant one, or that a benign growth may become malignant, this transition would not be noted so frequently in the literature if careful microscopic examinations were made in all cases.

Papilloma.—As J. Orth ("Lehrb. d. speciel. Pathol. Anat.," Berlin, 1889, Bd. ii, p. 214) very properly says, the general name papilloma may be given to the group of pedunculate tufted tumors as long as we do not know to which special class the growth belongs; it may be either a benign papillary fibroma or a malignant papillary cancer. We see from this that the term papilloma is often employed simply to describe the form and general appearance of the tumor, without conveying any information as to its real character.

If, on the other hand, we limit the term papilloma to the group of benign tumors, we are met with the further difficulty as to the propriety of the name according as we consider the tumor primarily an outgrowth from the epithelial or from the connective tissue.

If it is a tumor of the submucous connective tissue, covered by the mucosa and pushing out into the cavity of the bladder as it grows, then the proper name is papillary fibroma (Virchow, 1885); this view makes the papillomata one of the group of fibromata, which differ among themselves in possessing more or less connective tissue.

Clado, on the other hand, considers papillomata as epithelial growths of the mucosa of an exogenous type—that is, one in which the epithelium is confined to the exterior. This classification groups them with the adenomata and establishes also a certain relationship between them and the epitheliómata, which are of the endogenous (ingrowing) type.

The benign papillomata are made up of a framework of connective tissue, more or less abundant, richly supplied with blood vessels, and covered everywhere with the vesical epithelium. They usually have a tufted, villous, branching appearance, and are so vascular that the name "villous angioma" has been given to them. Sometimes the interspaces between the prolongations are filled with detritus, when the fungating appearance is lost.

They occur at any age—from six and nine months (Stein) to seventy-seven years (Gaillard); they may be either single or multiple, and they frequently complicate other tumors.

Clado distinguishes three varieties—the villous, the pedunculate, and the coronoid. The villous papilloma appears in the form of filaments growing from the surface of the mucosa, and they are more or less grouped. When the whole bladder is covered by them the name vesica villosa (Küster) has been given it. These filaments assume a shape like that of a finger or ribbon, cylindrical or conical, and often subdivide once or twice. The pedunculate polyps, constituting the commonest form, are grouped on a cylindrical pedicle which may be several centimeters long. In the coronoid form the affected portion of the bladder has the appearance of a number of crests closely applied and looking like a cock's comb.

In all benign papillomata the pedicle never passes beyond the limits of the mucosa, however thickened or infiltrated this may become by inflammation, although the base of the growth may sometimes contain muscular tissue. The size of a papilloma varies from that of a pea to a walnut; rarely they are as large as a hen's egg.

Fibroma.—The fibromata or fibroid polyps form a group of benign tumors in which the connective tissue elements are in excess. They are less frequent than the papillomata, which have but a scanty fibrous framework and appear to occur oftener in men than in women.

The tumor is usually pedunculate, its surface is smooth or slightly lobulated, and the pedicle is generally a delicate one. When the tumor is sessile and situated within the bladder wall, its connections with surrounding tissue are such that it can be enucleated. Although the pedicle and the mucous surface of the tumor are vascular, the interior is but poorly supplied with blood vessels. The fibromata often enter the group of mixed tumors by undergoing a myxomatous degeneration (see F. Schatz, " Fibromyxoma teleangiectodes vesicæ," etc., *Archiv f. Gyn.*, 1876, Bd. x, p. 356).

Adenoma.—The adenoma is a benign epithelial tumor of the glandular type, rarely met with; it is sessile or pedunculate, and has a smooth, lobulated, or papillary surface. When sessile, the tumor can be easily enucleated with the finger without hemorrhage.

It is difficult, in the light of our knowledge of the histology of the bladder, an organ which is remarkably deficient in glandular elements, to account for the origin of these tumors; for this reason Klebs and others have insisted that these growths must, in the male, take their origin in the prostate gland. R. Kaltenbach (Langenbeck's *Archiv für klin. Chir.*, 1884, Bd. xxx, p. 659), however, has described a papillary adenoma which he removed by a vesico-vaginal incision from a woman forty-four years old, the origin of which Prof. Boström traced to the mucous crypts of the bladder. Von Fritsch has also described a fibro-

DESCRIPTION OF PLATE III.

Fig. 1 shows the normal bladder laid open by an incision through the anterior wall. The ureteral orifices are seen as narrow slits at the two posterior angles of the trigonum; the third angle is at the internal urethral orifice. The trigonum is characterized by its increased vascularity between these three points. The longitudinal vesical folds entering the urethral orifice are well shown.

Fig. 2.—Secondary carcinoma of the bladder following carcinoma of the cervix. The carcinoma appears in the form of rounded nodules in the bladder wall, mainly in the vicinity of the cervix. One small nodule is seen in the trigonal area. Note also the thickened walls of the bladder.

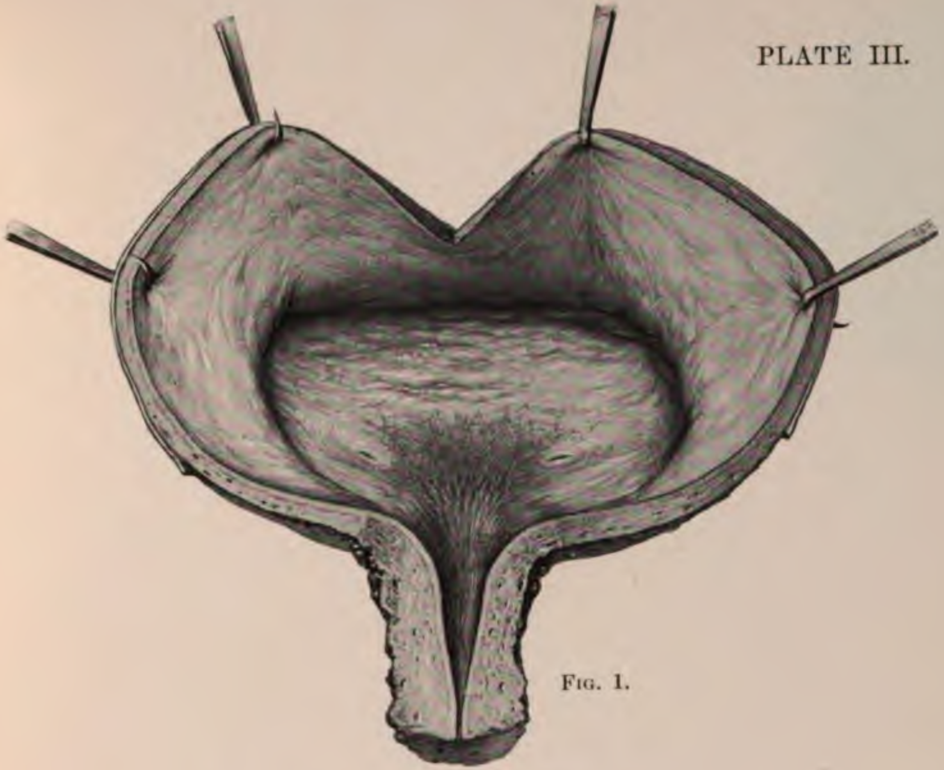


FIG. 1.

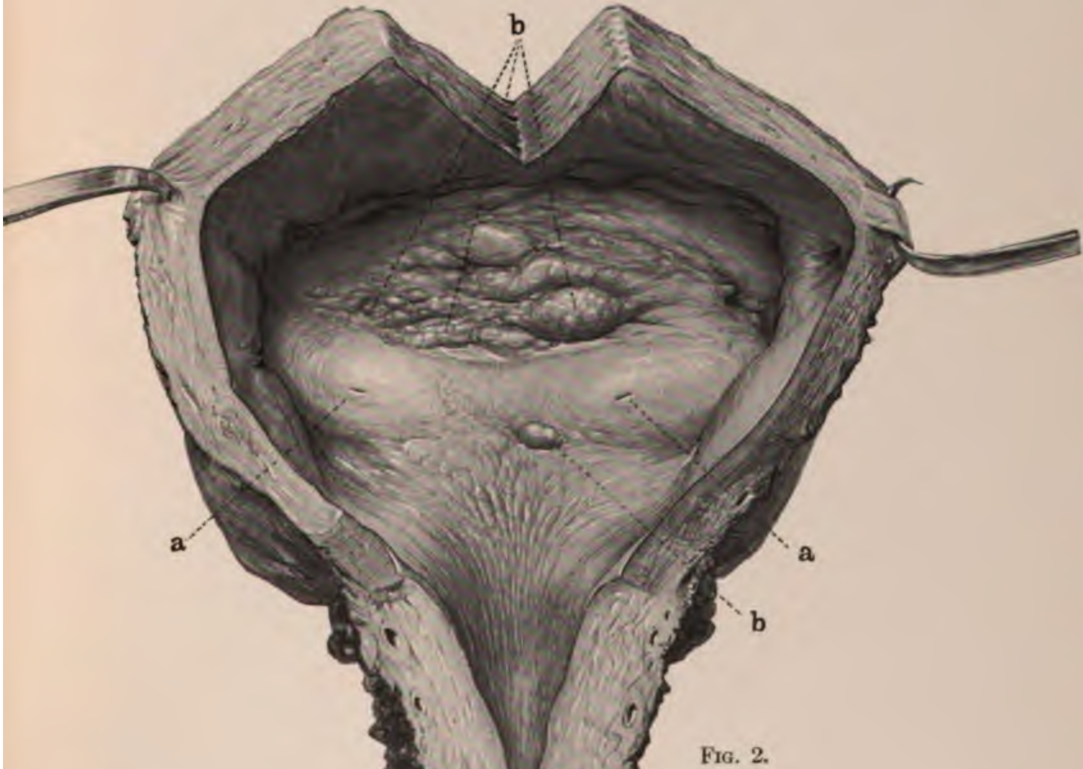


FIG. 2.

M. Brödel, fec.

Outside of these rare observations, cases have been recorded in which dermoid cysts outside of the bladder (see Sänger, *Archiv f. Gynäkol.*, 1879), or ovarian dermoids, have discharged their contents into this organ, and hairs have escaped by the urethra (pilimiction).

In the group of malignant tumors we find two types of tumors represented—the epithelial type, the carcinomata, and the connective tissue type, the sarcomata. The most frequent are the carcinomata, and these are commonest in men as primary tumors of the bladder, while in women they invade the bladder as secondary tumors extending from the uterus.

Carcinoma.—The carcinomata consist of two kinds of tumors, the first made up of the squamous and the second of the cylindrical celled epithelium; they are characterized by a tendency to infiltrate the bladder walls and invade all surrounding tissues. The tumors thus formed are usually multiple, and project into the lumen of the bladder, where they are covered with villosities ("villous cancer"); again others are mulberry-like in appearance. There are often several larger masses with broad pedicles, and a number of small tumors near by.

The infiltrating form of epithelioma without villosities is rarer than the vegetating villous form; the friability of these tumors is especially marked. In some cases the epithelioma can only be shown to have infiltrated the tissues by a microscopic examination (the larvaceous or masked form of Guyon). The surface is less frequently ulcerated in epithelioma than in carcinoma.

The carcinoma appears in the forms commonly known as encephaloid, scirrhus, or colloid cancer. The ulcerations most commonly observed in the infiltrating form arise either from fatty degeneration or interstitial hemorrhage or gangrene.

The walls of the bladder not involved in the new growth are hypertrophied, partly from the thickening of the muscular coat, and partly from an interstitial sclerosis, the product of irritation (Clado).

Cancer of the bladder exhibits the same tendency as does cancer of the body of the womb to remain localized for a long time in its own viscus, an important fact bearing upon the operative treatment.

These cancers are liable to undergo certain changes; inflammation easily supervenes in the exposed lowly organized tissues, especially after instrumental interference; cystic degeneration is common on the surface or in the walls of the growth, and gangrene may follow interstitial hemorrhages in infected cases.

Sarcoma.—The vesical sarcomata form a group of rare tumors of the connective tissue type, malignant in character.

The first description was given by Guersant (*Arch. gén. de méd.*, 1853, second series, p. 311), and since that time but few cases have been added to the literature. Albarran and Clado out of a large experience have only observed three instances.

McWeeney (*British Med. Jour.*, vol. i, 1893, p. 647), under the title of "Spindle-celled Sarcoma of the Urethra," reports a case, which from the description that follows was apparently a pedunculate sarcoma of the bladder.

The patient, a woman aged thirty-two years, had suffered from pain on micturition for some months, and was admitted to the Mater Misericordiæ Hospital under the care of Dr. Madden and Mr. Hayes, who found a soft vascular tumor projecting from the urethral orifice, and traceable along the roof of the urethra up into the bladder. On removal, it proved to be a typical spindle-celled sarcoma.

Sarcoma appears to occur about one-third oftener in women than in men, at almost any period of life from early childhood up to fifty-nine years of age. The tissue in which the neoplasm takes its origin is probably the stroma of the mucosa, which ordinarily contains round, embryonic cells.

The tumors are usually multiple, and almost always sessile, varying greatly in size and having, as a rule, a smooth surface; the color is red, violaceous, or even blackish. The parts of the bladder adjacent to the base are usually infiltrated. In women the sarcoma is especially prone to extend out through the urethra, appearing at the external orifice.

Myxoma.—Myxoma is a form of degeneration grafted upon one of the primary forms of tumors; it is always found, therefore, in a mixed form. The commonest are the myxo-fibromata and the myxo-sarcomata.

Such myxomata are usually pedunculate and occur in groups; they are commonly found in early life, grow on the floor of the bladder near its neck, and present much the appearance of nasal polyps; they are more vascular, however, as well as firmer. Owing to their situation, one of the tumors may easily escape from the urethra and appear at the vulva.

The tissue of the myxomatous tumor is made up of embryonic cells and myxomatous cells with anastomosing prolongations; the capillaries are numerous, and elastic fibers are found abundantly. They show a remarkable tendency to return rapidly after removal (see Schatz, *Archiv f. Gynäkol.*, Bd. x, 1876, on "Fibro-myxoma").

Clinical History of Vesical Tumors.—In their earlier stages the symptoms of tumors, both benign and malignant, are much alike. As a malignant tumor progresses, the emaciation and constitutional symptoms become pronounced features in the case, but these features may be simulated to some extent by a benign tumor associated with cystitis and hemorrhages.

The earliest and the commonest of all symptoms characteristic of vesical tumors of every kind is a decided tendency to bleeding from the bladder.

Clado has demonstrated, by an analysis of a series of cases, that a cystitis is the first symptom in 8 per cent of the papillomata, in 20 per cent of the sarcomata and myxomata, and in 25 per cent of the carcinomata and epitheliomata.

In a few cases retention or incontinence of urine are the first indications of the growth.

Hemorrhages from the bladder may appear in the form of urine more or less deeply discolored by blood, or in the form of clots, or it may be discovered only upon making a microscopic examination of the urine (colorless hemorrhage). They appear, persist, and disappear, to reappear without any apparent cause whatever; sometimes the urine remains bloody for years; in other cases a hemorrhage comes on after exercise, or some violent motion, as horseback riding. Little decolorized filaments and irregular clots of blood collecting on the interstices of the tumor and finally washed away by the urine are characteristic of villous tumors. Epithelial cells and fragments of the tumor may be found adherent to such clots.

When a large hemorrhage takes place, and the blood accumulates in the bladder, the distention may be so great as to reach even as high as the umbilicus.

Frequent micturition is another common symptom due to the presence of a tumor; the increase in frequency at first may scarcely be noticed, but later the bladder may require to be emptied every few minutes. When cystitis is superadded, this, of course, of itself induces both pain and frequency.

Suppression of the urine is brought about mechanically by a pedunculate tumor which lies near enough to the urethral orifice to cover it and interfere with the flow, or when the tumor is attached farther away from the orifice, but has a long pedicle. A tumor so placed as to press habitually upon one of the ureteral orifices, will in time cause a hydroureter and hydronephrosis of that side. A retention of the urine may be caused by a distention of the bladder with blood clots, and if the pressure from this source continues to increase, the urine may be even prevented from entering the bladder (anuria); the patient under these circumstances suffers from great pain and straining.

Pain is not a common symptom except when clots accumulate in the bladder, or when there is a coincident cystitis, which is one of the commonest complications liable to arise at any time, and exceedingly obstinate, rarely disappearing so long as the tumor remains.

Prognosis.—The ultimate outcome varies, of course, with the nature of the tumor; the benign cases run on for years and do harm by the severe hemorrhages, by the diminished capacity of the bladder, due to the presence of the tumors, or by the cystitis, which may be intense in its character and may travel upward, producing a pyelonephritis.

The malignant neoplasms destroy life in the course of a few years or sooner, according to the rapidity of their growth and to the occurrence of hemorrhages, cystitis, ulcerations, gangrene associated with renal infection, pyemia, or peritonitis.

Diagnosis.—The diagnosis of a vesical tumor is made by (a) a study of the history; (b) examination of the urine; (c) palpation of the bladder; and (d) a direct cystoscopic inspection.

Although the direct examination gives at once a positive diagnostic answer, the remaining means of investigation should not be neglected.

The history is, as a rule, in no respect characteristic.

The examination of the urine shows the presence of blood; and if there is cystitis, pus and micro-organisms as well as various crystals, and, rarely, bits of the tumor will be found. Earlier writers laid great stress on finding these pieces of the neoplasms, and judged from them the character of the disease. The opinion now held is that even when the presence of a tumor may be inferred in this way, no definite conclusions can be drawn as to its nature, not even as to whether it is benign or malignant.

One of the rarest symptoms, only observed in connection with vesical tumors, is the spontaneous coagulation of the urine (fibrinuria) after escape from the body, due to an excess of fibrin discharged with the blood into the bladder.

The use of a catheter to bring away a piece of a neoplasm in its eye is too uncertain, and the use of a curette, guided solely by touch, is too dangerous to be practiced, now that other simple and safe diagnostic measures are always available.

Palpation of a bladder emptied of its urine may give interesting information by revealing a localized thickening of the tissue, when a tumor of a size and consistency sufficient to be felt bimanually is present. Touch is especially valuable in the case of malignant tumors, in determining whether the disease has already passed beyond the limits of the bladder. In such a case the examination must be made with especial care through the lateral vaginal fornices to find any fixation on the side of the pelvic walls; and through the rectum to find any enlarged glands on the pelvic walls, or between the external and internal iliac arteries, or even up on the common iliac artery.

Direct Inspection.—This mode of investigation at once gives a positive answer to several important queries in the diagnosis: (a) Whether or not a tumor is present; (b) whether the tumor is single or multiple; (c) the seat of the tumor; (d) its size, form, and color; (e) the kind of pedicle; (f) any complicating conditions, such as calcareous incrustations, cystitis, and ulceration.

If examination pains the patient, it will be best to anesthetize her, and then, after emptying the bladder, to put her in the knee-chest position and introduce a No. 9 or 10 speculum. The examiner, looking into the air-distended bladder in this position, will see pendent any tumors springing from the trigonum or the base. By a minute investigation he will be able to determine in most cases the chances of a successful operation, although it may not always be possible to distinguish with certainty between malignant and non-malignant growths.

In general it will do to recall the fact that the simple papillomata have small pedicles, while the pedicle of a simple epithelioma is much stouter, and in a sarcoma it is quite broad. Any nodules about the base of the tumor will also be detected and should be regarded with suspicion.

The presence of a cystitis or of any ulceration of the surface of the bladder complicates an operation. When the tumors are found clustered around the neck of the bladder they may be looked upon as certainly malignant.

Operative Treatment.—There is but one way of treating vesical tumors, and that is eradication of them by operation whenever possible. A palliative plan must be adopted only when the condition of the patient or the extent of malignant disease forbids operation.

The conditions most favorable for operation are general good health, urine clear from infection, albumin, and casts, and a single tumor with a pedicle. In old age, and in childhood under five years, the tumor is almost certainly malignant and inoperable.

Before proceeding with the operation it is important to gain an exact estimate of the patient's general condition, and to have made one or more thorough cystoscopic examinations for the purpose of studying the peculiarities of the tumor.

The avenues of extirpation are: (a) By the dilated urethra; (b) by a vaginal incision; (c) by suprapubic incision; (d) by symphyseotomy; (e) the removal of the entire bladder (cystectomy).

The choice of the mode of operation will depend on the size of the tumor and its pedicle, on its seat, and on the presence of such complications as multiple tumors, infection, anemia, and extreme prostration.

The least dangerous ways of operating are by the dilated urethra and through a vaginal incision.

The suprapubic incision is more formidable on account of the risk of opening the peritoneum and urinary infiltration or infection of the loose cellular tissue, and the symphyseotomy is the most formidable of all.

The operation in a particular case may be no more than the severance of a delicate pedicle setting free a tumor, or it may involve the resection of a portion of the mucosa, or a portion of the entire bladder wall, or in extreme cases the sacrifice of the whole bladder.

(a) By the Urethra.—Simon (*Samm. klin. Vortr.*, 1875, No. 88, p. 8) has shown that the urethra may be safely dilated to a diameter of 2 cm. after making two lateral incisions in the posterior margin of the external urethral orifice to keep it from tearing at this its narrowest part. A series of dilators differing 1 mm. in diameter is then passed in, beginning with a No. 8 or 10 and ending with No. 20. After this the largest speculum (No. 20) may be inserted and the tumor exposed for operation. Through a speculum of this large size we may safely remove most of the pedunculate tumors of the bladder, either by the galvano-caustic loop, or by using a delicate, properly bent cautery knife.

In employing either of these means to extirpate the growth, it is possible, under the control of the sight, to adjust the loop or to use the knife so as to effect an amputation close to the bladder; this avoids leaving any portion of the pedicle behind, and produces also a slight destruction of tissue on the bladder wall itself, sufficient to prevent recurrence of a benign growth.

A tumor removed in this way must be carefully examined microscopically, and if it is found to be malignant the operator must be prepared to resect a portion of the bladder wall through a vaginal or a suprapubic incision as soon as inspection shows there is any evidence of return. Sessile tumors and infiltrating growths can not be treated in this way.

(b) The vaginal route (colpocystotomy) is best when a limited portion of the bladder wall has to be excised with the tumor. It is easier to operate in this way upon the upper portion of the bladder when the vaginal outlet is relaxed and the anterior wall naturally tends to drop down; it is awkward and difficult with a tight vaginal outlet.

To make the vaginal incision the perineum is retracted and the cervix fixed with tenaculum forceps; the base of the bladder is then cut through onto a sound introduced through the urethra, and the incision enlarged, if need be, forward to the internal orifice and back to the cervix. An easy way of opening the bladder and exposing the tumor is found by placing the patient in the knee-chest posture, allowing the bladder to become filled with air, and then incising the septum as described on page 460. The edges of the incision are now drawn apart and the neoplasm, already located cystoscopically, is drawn through the opening into the vagina, everting with it the contiguous portion of the bladder wall. If it occupies but a small area, it may now be excised piecemeal, suturing step by step, and, if the bleeding is free, tying the sutures as they are passed. If the area of excision is a larger one, and if the cut goes deeply into or through the bladder wall, it will be best to transfix the wall in several places at a distance from the field of operation, to hold it in place while the extirpation and suturing are going on; by doing this the great risk of hemorrhage and delay from the open wound pulling back into the bladder will be avoided.

If the field of extirpation lies in the neighborhood of the intravesical portion of a ureter, it will be safer to insert a bougie beforehand so as to protect it.

(c) Suprapubic Incision (hypogastric route).—By this avenue tumors of larger size may be safely extirpated and the operation securely controlled throughout when it is necessary to extirpate any considerable portion of the bladder with the tumor.

The important practical questions whether the bladder may be safely sutured so as to avoid the risk of peritonitis after cutting into it on the peritoneal side, and whether any considerable part of the bladder may be removed and the defect made good by proper suturing, can be readily answered by some of the accidents met with in removing large myomatous uteri. I have several times cut into the bladder and closed the incision with interrupted sutures without any ill consequences. In one case I cut off a piece of the bladder as big as the palm of my hand, and closed the defect by interrupted sutures in the muscular coat without any after-effect.

The bladder may be exposed either by a transverse incision, which gives more room, or by a vertical incision in the median line; the disadvantage of the transverse incision is the severance of the recti muscles and the liability of the wound to gape open during the healing. If it is possible to avoid it, the peritoneum ought not to be opened, on account of the increased dangers of infection, dangers which are greatly multiplied when cystitis is a complication.

The incision begins just above the symphysis pubis and is made 6 or 8 cm. (2½ to 3 inches) long. The prevesical space is exposed, and the peritoneum is pushed up off the anterior abdominal wall, so as to expose the vault of the bladder; if the pelvis is a deep one and the abdominal walls thick, it is well to fill the bladder beforehand with water so as to bring it within easy reach, just under the incision. In a thin patient there is no difficulty in picking it up and opening it. A vertical incision is now made through the muscular and mucous coats of the bladder long enough to give plenty of room to get at the tumor and handle it easily. When the tumor lies deep down in the pelvis and is hard to reach, the steps of the operation will be greatly facilitated by temporarily attaching the sides of the incision in the bladder to the skin of the abdominal incision, so as to hold the whole bladder well up in view and within easy reach.

Superficial tumors covering a wide area may be extirpated by incising the mucosa on all sides and dissecting it up so as to remove it with the tumors. Almost the whole of the vesical mucosa may be taken away and yet it will regenerate, but wherever little islets or strips of sound mucosa can be left, this should be done, as the new mucous membrane starts to grow from these centers. As much of the defect as possible should be covered in by drawing together the remaining mucous membrane with a continuous catgut suture.

When the disease goes deeper than the mucosa it is safe to excise even the entire thickness of the bladder wall, if necessary trenching on its peritoneal portion as well. In this way a large part of the bladder, a half or even two thirds of it, may be resected, and the portion remaining will be able in great measure to maintain its function. After cutting through the walls, the rest of the bladder can be loosened from its attachments by a blunt dissection with fingers or a knife handle. On the vaginal side, although adhering more closely, the bladder can be detached in the same way without opening the vagina. All bleeding vessels should be tied at once with catgut.

After resection, the wound must be accurately closed, when possible, by interrupted catgut sutures applied close together, after which the bladder is kept empty from six to eight days by drainage through the urethra. The way in which the sutures are tied will depend on the position of the tumor; when this is situated on the base or on either side they may all be tied inside the bladder, but when the growth is at the vault they should be tied on the outside. Each suture tied on the outside should grasp the muscular surface alone; those on the inside should include the mucosa too. When the peritoneum is cut, this should be drawn over the line of sutures to form an additional protection to the abdominal cavity.

If the tumor occupies the site of one of the ureteral orifices it will be easy to extirpate it, first cutting off the end of the ureter, if necessary, and transplanting it into a part of the bladder posterior to the wound. I should do this by puncturing the bladder wall on that side where I wished to introduce it, loosening the ureter and bringing it through the opening. The new ureteral orifice should be cut obliquely and attached to the bladder, in its new position, by four or five fine catgut sutures. The wound made by taking out the tumor may then be closed by interrupted catgut sutures, taking in all layers. After closing the bladder wound perfectly, the abdominal wound should be brought together by silkworm gut sutures through the fascia, and catgut through the fat and the skin.

If the wound in the bladder can not be perfectly closed, it is necessary to use a gauze drain above the pubis as well as by the urethra, so as to avoid urinary infiltration of the tissues; when the wound begins to close down to a small opening a rubber tube may replace the gauze.

Sonnenburg (*Berl. klin. Wochenschr.*, 1884, No. 52) describes a resection of the bladder in a woman for a fibro-sarcoma. The tumor on the anterior wall of the bladder was 3 or 4 cm. in diameter, and had an ulcerated surface. A suprapubic incision was made, the bladder freed, and the tumor excised, leaving only a part of the posterior wall and the base of the bladder with the ureters. The peritoneum, which had been opened, was brought together by suture, and the bladder drained, both by the urethra and through the abdominal wound, which was left to close by granulation. The patient survived the operation five weeks.

(d) Symphyseotomy is used to secure a large field of operation where the tumor is situated at the neck of the bladder, but the bladder in women is so accessible by the suprapubic route that it can hardly be necessary in any case to resort to so serious a procedure.

(e) Cystectomy.—The removal of the entire bladder is required when its whole wall is occupied by a malignant growth, but it rarely happens that a patient with such extensive disease is in condition to stand such an operation, even if the disease has not extended beyond the bladder.

The following case of cystectomy admirably devised and successfully practiced by K. Pawlik (*Centralb. f. Gynäkol. Beilage*, 1890, p. 113) deserves careful study as a model on which to base any similar attempts in the future; it was conducted by the following steps: Transplantation of the ureters into the vagina; extirpation of the bladder; construction of a new bladder out of the vagina.

The patient had complained of painful micturition and bloody urine, and the removal of a vesical polyp was followed by relief for a time; but later, papillary growths of the bladder, accompanied with hematuria, gave so much distress that Dr. Pawlik determined to remove the entire bladder.

On August 3, 1889, he performed a preliminary operation—the establishment of uretero-vesical fistulæ. Having introduced a Simon speculum into the vagina and sounds into the ureters to mark them out, he dissected them free from the bladder by a vaginal incision 2 cm. long, tied silk ligatures around them on the vesical side, split them open longitudinally, and then sutured the openings with fine silk sutures into the upper part of the vagina; he then cut off each ureter below the ligature. The discharge from the bladder no longer receiving any urine, was at first a thick, brownish liquid, but later it contained nothing but some mucus.

Three weeks later the bladder was extirpated; after suitably preparing the field of operation he filled the bladder with an iodoform emulsion, and introduced into the ureters elastic sounds with mandarins. He then made an incision 10 cm. (4 inches) long in the linea alba, extending down to the symphysis pubis, and then, without cutting into the peritoneum, he detached the distended bladder easily on all sides, except at the artificial ureteral openings into the vagina. Here there was considerable hemorrhage, which was controlled by tampons. Having dissected the entire bladder free down to the urethra, he finished the operation of removing it by the vaginal route. A transverse incision was made in the anterior vaginal wall just above the urethra, and the emptied bladder was drawn through this opening and severed in the plane of the internal urethral orifice. As the papillomata grew thick about the orifice, he dissected away the mucosa widely around this point.

The urethra was finally fitted into the vagina by suturing its anterior wall to this transverse vaginal incision, and attaching the remaining portion to the lateral and posterior walls of the vagina, which was now denuded around its entire circumference. This had the effect of converting the vagina into an artificial bladder, and of retaining the entire urethra as its outlet. The abdominal wound was drained.

The suprapubic fistula was long in closing, as was also a fistula behind the urethra, and there was at one time an obstruction of the right ureter. This was, however, relieved, and a quantity of urine escaped. The patient recovered and with a small fistula had good control of the new vaginal bladder, which had a capacity of 400 c.c.

CHAPTER XVIII.

AFFECTIONS OF THE URETERS.

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2. Physiology (p. 483).
3. Methods of examining the ureters (p. 484): 1. Inspection. 2. Palpation. 3. Catheterization: (*a*) Instruments used; (*b*) introduction of speculum and location of ureteral orifices; (*c*) introduction of the flexible silk catheter; (*d*) how to secure urine from both ureters at the same time; (*e*) how to obtain uncontaminated urine; (*f*) how to secure urine directly from the ureter without catheterizing; (*g*) catheterization of the ureters without elevation of the pelvis and without atmospheric distention of the bladder; (*h*) points to be observed in securing separated urines; (*i*) analysis of separated urines. 4. Sounding the ureters. 5. Catheterizing the pelvis of the kidney: (*a*) Flexible silk catheter; (*b*) introduction of the catheter. 6. Asepsis. 7. Ureteral fever.
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ANATOMY.

THE ureters (see Figs. 27–29, Chap. IV) are two symmetrically disposed, flattened, whitish cords, lying in the loose connective tissue behind the abdominal and pelvic peritoneum, from 25 to 30 cm. (10 to 12 inches) long. The left ureter is longer than the right because of the higher position of the left kidney. Each ureter is funnel-shaped at the renal pelvis, follows an irregularly curved course, and terminates at a little eminence (in the knee-chest posture) in the bladder at the end of the inter-ureteric fold. The diameter of its lumen is about 3 mm., and is uniform throughout except at each extremity, where there is a slight narrowing. The abdominal portion is from 2 to 3 cm. (¾ to 1¼ inches) longer than the pelvic portion.

The course of the abdominal portion of the ureter, from renal pelvis to pelvic brim, starts out from the kidney 4 cm. (1½ inches) from the median line, curves forward over the psoas muscle and then inward until it reaches a point, at about the middle of its length, from 2.5 to 3 cm. (1 to 1¼ inches) distant from the median line; here it diverges slightly outward and crosses the pelvic brim 3 cm. (1¼ inches) from the median line.

Throughout the larger part of its abdominal course it lies upon the great psoas muscle, which it crosses obliquely. It holds no important relationship to any other vessels until joined at about the middle by the ovarian veins and artery. On the right side, above the brim of the pelvis, it lies behind the caput coli and the ascending colon; on the left side it lies behind the sigmoid flexure at the brim, and above this behind the descending colon.

The whole of the abdominal portion of either ureter can be exposed through a lateral incision without injuring any important structure, ligating any vessels, or opening the peritoneum, by simply lifting up the ascending or descending colon and drawing the bowel toward the median line.

At the brim of the pelvis each ureter lies upon the common iliac artery, crossing it at about 3 cm. (1¼ inches) from the middle of the sacral promontory; just below this it crosses the common iliac vein as it drops into the pelvis beside the internal iliac artery, and usually behind it.

The ovarian vessels cross the ureter, and leave it at the brim as they enter the top of the broad ligament.

Within the pelvis the ureter pursues a sigmoid course, running at first behind the peritoneum of the posterior lateral pelvic wall, close to the internal iliac artery, then turning forward and crossing under the uterine artery, and passing through a sort of membranous foramen at the base of the broad ligament halfway between the cervix and the pelvic wall, nearer to the cervix on the left side. Beyond the cervix it runs at first parallel to the upper anterior vaginal wall, which it crosses, to pierce the bladder wall obliquely forward and inward, ending at the ureteral orifice at the trigonum vesicae.

The landmark for the first part of the pelvic portion of the ureter is the internal iliac artery. The ureter can be found on a rectal examination lying just behind the artery, which it sometimes crosses so as to lie in front of it.

In its relation to the vaginal walls the lower ends of the ureters may be located by the "ureteral folds" seen on the anterior vaginal wall.

PHYSIOLOGY.

The function of the ureters is simply to transmit the urine from the pelvis of the kidney to the bladder. This function is an active and not a passive one. The urine first accumulates in the renal pelvis and then enters the ureter intermittently, where it is caught and carried down by a peristaltic wave about 2.5 cm. long, which travels the length of the ureter every ten to twenty or thirty seconds. As the wave passes, there is a distinct vermicular movement, at first a contraction, then a lengthening of the ureter, which moves forward under its peritoneal cover. I have seen this phenomenon repeatedly in the course of operations. I have also excited the wave movement by light tapping, or by lifting the ureter up, pinching, and dropping it; this act may also excite a reverse peristalsis. Each ureteral contraction is signalized at the orifice of the ureteral catheter by the sudden expulsion of a few drops of urine, or if the caliber of the catheter is quite small, by a jet lasting two or three seconds. An observer watching the vesical orifice of the ureter with the patient in the knee-chest position sees little jets of urine spurting out every few seconds. The inner coat of the normal ureter is not sensitive to the contact of the flexible silk ureteral catheter as it is introduced.

METHODS OF EXAMINING THE URETERS.

The ureters can be examined by inspection, palpation, catheterization, and sounding.

Inspection.—But one portion of the ureters, the vesical orifices, can be seen by a cystoscopic examination without a preliminary operation. When the patient is in the knee-chest position, a distinct ridge is often seen on the vesical mucosa extending from each ureteral orifice out to the pelvic wall, which corresponds to the lower extremity of the ureters. I have exposed and examined the vaginal portion of the ureter by an incision extending from the vault halfway down through the antero-lateral vaginal wall. By separating the edges of the incision, the ureter will be found in the loose cellular tissue just above the vagina, close to the pelvic wall. It can be located with greater ease if a bougie has been placed in it beforehand, converting it into a hard cord easily distinguished.

The posterior pelvic and lower abdominal portions on either side can readily be inspected, when the abdomen is opened, by drawing the sigmoid flexure toward the right side to expose the left ureter, and by lifting up the caput coli and drawing it also to the right to expose the right ureter. The ureters appear as whitish, flat cords, often with a little tortuous artery coursing down each, beneath the peritoneum, and lying close to the inner side of the ovarian vessels at the brim of the pelvis. If not seen, the ureter can be found by picking it up just above the brim of the pelvis with the ovarian vessels and the adjacent cellular tissue; the ovarian veins collapse at once on pressure, and the artery is small, but the ureter forms a distinct flat cord readily recognized by touch. This cord is easily followed by touch and sight down over the pelvic brim, and then, by holding it out from the pelvic wall and floor, a sort of meso-ureter is formed, and it is traceable as far forward as the uterine artery.

If there is much fat in the abdomen it is sometimes hard to find the ureter. In such cases I pick up a fold of peritoneum overlying the common iliac artery near its bifurcation and incise it for 2 or 3 cm. (¾ to 1 inch). By drawing apart the edges of this incision and getting rid of the fat and then looking closely, the ureter will be found beneath. If necessary to trace it farther, it may be held up and the peritoneum split up or down, laying it bare.

The abdominal portions of the ureters can be laid bare for inspection by incising the peritoneum reflected over the ascending and descending colon on the outer side, where there are no vessels; then, by displacing the colon toward the median line, the ureter is exposed on the psoas muscle.

I have also inspected the entire abdominal portion of the ureter through an incision beginning in the flank in front of the quadratus muscle and extending down just above and parallel to the brim of the pelvis as far as the anterior superior spine. This can be done most conveniently when the kidney is removed and detached from everything but the ureter. By pulling the ureter so as to make it tense, its course is easily followed by the finger down in the loose cellular tissue. It is important to do this in tubercular disease of the kidney in order to see if the ureter is also involved, or in the case of a suspected stone in the ureter.

Palpation.—The whole pelvic portion of the ureter is accessible to palpation in two ways—either by the vagina or by the rectum.

By the vagina the ureters are most accessible to palpation at their lower extremities, from the bases of the broad ligaments beside the cervix down to the terminus in the bladder. To palpate the ureter the bladder and rectum should be empty, and the patient should lie on her back with flexed thighs. The index finger is now carried high up into one of the vaginal fornices, pushing it upward and outward toward the pelvic wall, which is then gently stroked downward and backward. The ureter feels to the finger tip like a flat cord which is constantly slipping away. The cord is palpated again and again, the finger being brought nearer the outlet each time, and so tracing the course of the ureter down the pelvic wall to the point at which it passes between the anterior vaginal wall and the bladder.

Sometimes the ureter will be found lying close to the pelvic wall, and at others in the loose cellular tissue several millimeters distant. When the ureter is out of easy reach, it can be better felt by a bimanual examination, the upper hand pressing down through the abdominal wall. By this maneuver the abdominal hand displaces the organ slightly, and at the same time offers a plane of resistance against which the ureter can be readily palpated by the vaginal finger. In advanced pregnancy, where the head is low in the pelvis, the ureters are markedly displaced, and can be felt with extraordinary distinctness against the child's head.

In palpating its lower extremity the ureter is distinguished by its direction, its size, its consistency, and its mobility. It may be confused with an obturator artery pursuing a course parallel to the vagina, but the artery is small and round, and it will be felt to pulsate. The obturator nerve lying parallel to the course of the ureter may be traced down to the obturator foramen; pulling on the nerve produces pain. The sharp tendinous arch of the levator muscle may also be mistaken for the ureter, but a closer palpation will correct this source of error, as well as the impression at first produced by strands of the internal obturator muscle.

The ureter lies loosely in its cellular bed, and so can be sometimes displaced downward 1 or 2 cm., and if a hand rests over the abdominal portion at the pelvic brim in a thin patient, when a finger draws down the vaginal end and lets it snap back, like a cord of a bow, the impulse may sometimes be felt at the brim of the pelvis.

The normal ureter can only be palpated with certainty through intact abdominal walls at the pelvic brim when the walls are extremely thin. I have felt them distinctly through the lax umbilical ring immediately after childbirth. A diseased ureter, usually extremely sensitive, can be readily located by the pain on pressure at its point of transit from the abdomen into the pelvis.

To make this examination the patient lies on her back with shoulders raised on a pillow and thighs moderately drawn up; the large bowel and bladder must be empty. The examiner stands on the side he wishes to palpate and begins by making a gradually increasing deep pressure through the abdominal walls until the promontory of the sacrum is found; 3 cm. (1¼ inches) to the right or left side of this point and a little below it, is the point at which the ureter crosses the pelvic brim. By making deep pressure through the semilunar line over the brim at this point in an oblique direction from above downward, and sliding the fingers up and down, the patient will at once complain of pain, and possibly of a desire to urinate if the ureter is inflamed. A large diseased ureter—tubercular, for example—will feel through a thin abdominal wall like a stout cord rolling under the fingers.

The abdominal portion of an inflamed ureter above these points may be traced by following the line of tenderness developed on making deep pressure.

By the rectum the ureter can be felt from the pelvic brim to the pelvic floor through the empty bowel; the left ureter is the more accessible. The pelvic floor is invaginated by strong pressure and the finger carried up to the bifurcation of the common iliac artery, from which point down the internal iliac artery is easily followed. Guided by these landmarks, the finger palpates carefully behind and close to the internal iliac artery until a flat yielding cord (the ureter) is detected, which can be traced at first downward and then forward. A ureter whose walls are thickened can be still more readily found and palpated. If the ureter is not found in this way, it can be palpated with perfect ease throughout the whole pelvic course by first placing a hard-rubber bougie or a catheter within it.

In abdominal operations, when the broad ligament is opened, if the ureter is not marked out by a catheter lying in its lumen, it may be found by touch alone by separating the anterior from the posterior layer of peritoneum, carrying the thumb and forefinger deep down to the pelvic floor, and then gathering up the cellular tissue and letting it slip out between the fingers; after a few efforts the ureter will be distinctly recognized, and then easily traced in its course into the anterior part of the pelvis.

Catheterization.—The most important means of investigation at our command is catheterization; by this we may establish the existence of a stricture, a hydroureter, a pyoureter, or a calculus of the ureter, we may secure evidence of disease of the kidney above, or settle the question as to whether one or both ureters are involved; catheterization also gives precise information as to the extent and location of the disease.

We are able by catheterization to receive directly from the ureter the urine discharged from the kidney, without contamination with the surface of the bladder and urethra, and before mixture with the urine from the opposite kidney. By catheterizing both ureters and leaving the catheters in place, the urine from both kidneys may be collected separately, throwing the bladder for a time entirely out of use. Catheters may be left in place for several hours, or even in exceptional instances, as suggested by Dr. F. Henrotin, for three or four days. The utmost pains must be taken throughout to avoid the introduction of septic matter into the ureter by the catheter.

The best way to catheterize the ureters in women is under an atmospheric distention of the bladder, secured by posture, and a direct inspection of the ureteral orifices through a cystoscope.

The following instruments are required:

A conical urethral dilator; several specula with obturators, Nos. 8, 8½, 9, 9½, 10; a light; a head mirror; an evacuator; long recurved mouse-toothed forceps; a ureteral searcher; flexible ureteral and renal catheters; a metal ureteral catheter; hard-rubber bougies; and a series of dilating catheters.

A description of the urethral dilator, various specula, light, mirror, evacuator, forceps, and searcher, used also in examination of the bladder, has been given in Chapter XVII.

Flexible Catheters.—Flexible catheters which readily follow the curves of the ureters and do not injure them during introduction, are used to drain the urine from the ureters; they can easily be carried beyond the pelvis into the abdominal portions even as far as the kidneys; there is also no danger in their use of hurting the patient, or of the catheter slipping out during the subsequent manipulations necessary to put the patient in a satisfactory position in the bed, when the catheter is to be left in for any length of time.

Two kinds of flexible catheters are made, ureteral and renal, differing only in length, the former 30 cm. (12 inches) and the latter 50 cm. (20 inches) long. These catheters are made of woven silk, many times coated with varnish and rubbed down until they have a highly polished surface. The end of the catheter is blunt and conical, with a large oval eye 2 cm. (¾ inch) from the tip. Both kinds are made in diameters which run from 1¾ to 3 mm. The following sizes are furnished: 1¾, 2, 2¼, 2½, 2¾, 3. The name of the size specifies the diameter in millimeters.

It is possible, in almost all cases, to introduce a catheter into the ureter through one of the plain cylindrical cystoscopes without anesthesia and without any, or but slight, dilatation of the urethra. The bladder should be distended with air by the knee-chest or elevated-dorsal posture and illuminated by a simple reflected light (see Chapter XVII).

A wire stylet is necessary to give the catheter the needed stiffness during its introduction into the ureter. The catheters should be kept dry and straight.

If they are bent they tend to crack and blister, and little scales rise which cut like a knife. After use each catheter should be thoroughly cleansed by forcing through it with a syringe a warm bichloride of mercury solution (1 to 1,000), followed by warm water. After septic cases it must be sterilized by boiling two minutes in pure water, after which it should be laid away in a sterilized towel or cloth in a warm place and kept quite straight four or five days until thoroughly dried, when it may be put away in a case until wanted for further use. It is especially important to make sure that no particles of dirt are left in the lumen of the catheter; macroscopic particles can be detected by the interference with the flow of water from end to end, as well as by holding the catheter up to the light and inspecting its lumen in this way. It is my habit to preserve my catheters in bulk in a simple, stout glass tube 2.5 cm. in diameter plugged at the ends with cotton. A little sterilized soapstone powder keeps them from adhering to one another. In addition to this I keep a case of catheters of different sizes ready for immediate use, each one of which is inclosed in a glass tube 1 cm. in diameter and a few centimeters longer than the catheter, and plugged at both ends with sterilized cotton. In a warm house the catheters will be stiffer for use if they are laid in the refrigerator for an hour. A convenient way to carry these tubes about is in a case made of two pieces of canvas stitched together lengthwise so as to form a series of compartments, each one of which accommodates a glass tube. The case is stiffened at the sides by a piece of stout wire sewed in the edges, keeping it from bending and breaking the tubes.

The Metal Ureteral Catheter.—A metal catheter is sometimes useful when the ureter is strictured at its lower end or when its canal is tortuous. Under these circumstances a flexible catheter may refuse to enter, but a metal catheter can be carried through the constriction and up a twisted canal guided by the sense of touch.

The catheter is 29 cm. (12 inches) long and 2½ mm. in diameter, slightly curved, and with a small, blunt, olive point at its ureteral end. Three oval eyes, 1 by 2 mm., back of the point afford a free exit for fluids. The outer end of the catheter is slightly curved to carry the fingers clear of the lumen of the speculum during the introduction;

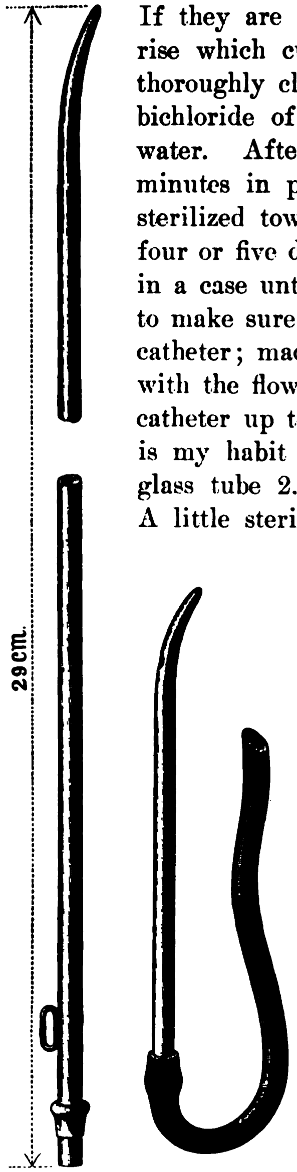


FIG. 275.—LEFT-HAND FIGURE, LONG METAL URETERAL CATHETER FOR THE LOWER PART OF THE URETER.

Used chiefly in stricture of the vesical end of the ureter. The short metal catheter with the rubber tube is often used to collect the urine from one side when a long flexible catheter can not be carried up to the kidney. A catheter ½ to 1 mm. smaller in diameter than that shown in the figure is usually used.

a plug attached by a chain keeps any fluid in the ureter from escaping until the catheter is introduced.

Dr. Reynolds, of Boston, has had a flexible metal catheter made of block tin.

Ureteral Bougies.—Solid metal bougies, 30 cm. (12 inches) long and shaped like the metal ureteral catheters, are often serviceable in testing the permeability of the lower end of the ureter, or in recognizing a calculus in its pelvic portion, or in locating and dilating a stricture in the ureter not far from the bladder. I have had a series of these bougies made 2 mm. in diameter, with a bulbous enlargement about 7 mm. back of the point, varying in size in the different numbers of the series from one which is but slightly larger than the shaft of the bougie itself up to one 4 mm. in diameter. I have tested whalebone and found that, on account of its elasticity, it does not make a good ureteral bougie. The best bougies are made of hard rubber 2 mm. in diameter and 50 cm. (20 inches) in total length. There is a slight narrowing below the end which is rounded off into a point shaped like an olive. The handle, large enough to be taken conveniently between the thumb and forefinger, is 6 cm. (2½ inches) in length and passes easily through the No. 8 vesical speculum. This bougie easily adapts itself to the curves of the ureter and can be pushed on up into the pelvis of the kidney without danger. It becomes more flexible when warmed.

The ureteral and renal catheters are also made without any eye for use as flexible bougies; these are the safest in performing hysterectomy, on account of the liability of the hard rubber to break when bent suddenly and sharply.

I have also had a long hard rubber bougie made with a little notch running lengthwise at the tip on two sides, intended to catch and hold the dental wax with which the end is coated when the bougie is used as a searcher for a renal calculus. If a calculus is present and the bougie comes in contact with it, the shining impressionable surface of the wax is scratched, and the scratch marks can be seen under the lens of a low magnifying power. A silk renal catheter tipped with wax detects the stone equally well, and so serves the double purpose of bougie and catheter.

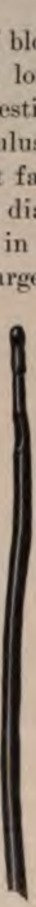


FIG. 276.—CATHETER TIPPED WITH A MIXTURE OF WAX AND OLIVE OIL.

The highly polished surface is scratched or gouged on coming into contact with a stone.

Dilating Catheters.—The dilating catheters are used to dilate ureteral strictures near the bladder. They are nickel-plated metal tubes, 25 cm. (10 inches) in length, slightly curved at the tapering conical point, which is well rounded and blunt so as not to hurt the ureteral wall. The slight curve, which is shown in the picture, facilitates the introduction through a stricture. There are four eyes, arranged in pairs, one eye below the other on opposite sides of the catheter, and located within 2 cm. of the end. The outer end of the catheter is curved in an opposite direction from the curve of the point, so as to keep the fingers out of the way during introduction. At the outer end there is a little bulbous enlargement to hold rubber tubing slipped over it; a plug and chain are attached to keep the catheter closed until introduced. The sizes vary in diameter from 2½ to 6 mm., the difference between the sizes being half a mm.

Introduction of the Speculum and Location of the Ureteral Orifices.—The bladder is first emptied of its urine by voiding it in a sitting or a standing posture. The evacuation is more complete when it is so voided than when drawn by catheter in the dorsal posture. The patient is then placed on a table in the knee-chest or elevated-dorsal position, the labia separated, and the urethral orifice exposed and cleansed with a boric acid solution to avoid carrying surface contamination into the bladder on introducing the speculum.

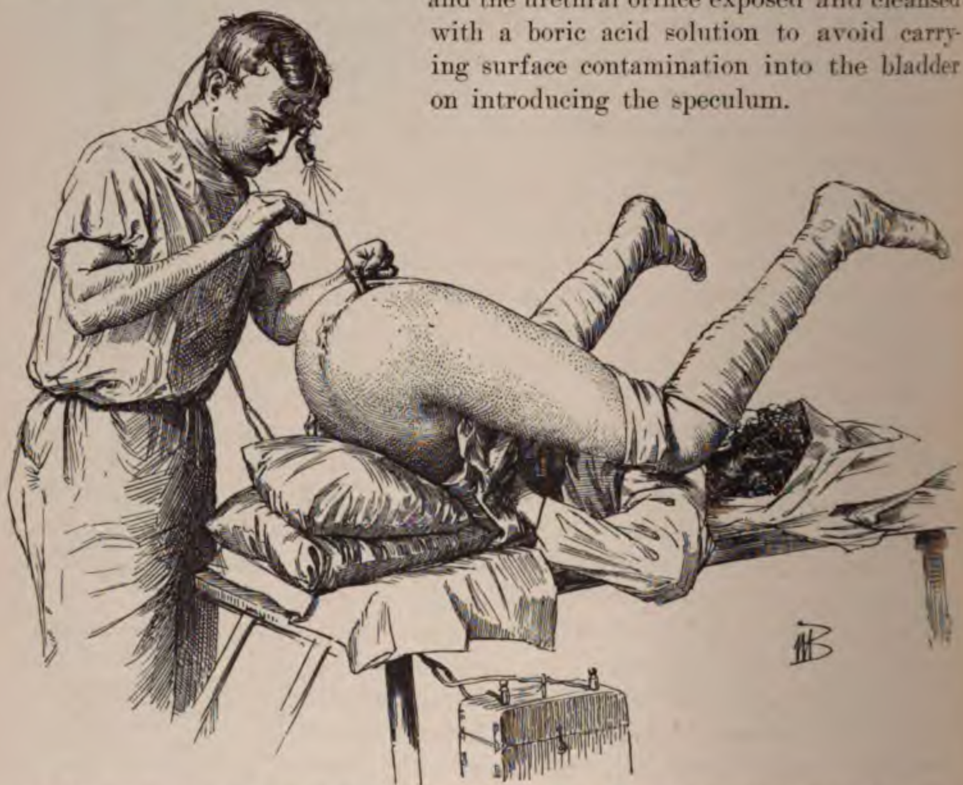


FIG. 277.—SOUNDING THE LEFT URETER WITH THE SEARCHER BEFORE INTRODUCING THE CATHETER. The patient is in the elevated-dorsal position, and the electric headlight is used to illuminate the bladder.

A bladder speculum, No. 8, 9, or 10, is introduced as described in Chapter XVII. The light is then reflected into the bladder, and illuminates the posterior wall. The speculum is next withdrawn until the internal urethral orifice begins to close over the end, when it is pushed farther in, about a centimeter, and turned from 25 to 30 degrees, either to the right or left, while the handle is dropped to bring the base of the bladder into view. The ureter itself, or the area immediately adjacent to it, now lies within the field of vision, about

1.5 cm. (½ inch) distant from the end of the speculum. In thin patients the dorsal posture works very well, but in a patient of medium size the bladder may not distend well until she assumes the knee-chest position. Stout women must always be examined in the knee-chest posture.

In virgins and nulliparæ the bladder walls balloon out so much upon atmospheric distention that the base is carried up toward the sacrum, and becomes so markedly concave that the ureteral openings can scarcely be seen; if the patient is in the knee-chest position, the observer has to drop the handle of the speculum to such an extent that he is obliged almost to bring his head under the pelvis to find them. This difficulty will be obviated by first introducing into the vagina a little speculum, not more than 1 to 1½ cm., which lets in the air and causes the anterior vaginal wall to drop down, bringing the base of the bladder into the plane of vision. If the distention is still too great after this maneuver, the difficulty may then be overcome by introducing within the vagina a cotton pack large enough to hold the anterior wall down, or a small inflatable rubber bag, or an instrument shaped like a spatula with a strongly curved handle to make pressure on the vaginal wall and bring the ureteral orifice into view.

While the ureter is generally found at an angle of from twenty-five to thirty degrees with the urethra, it may be either more or less. I have often seen it upon simply carrying the speculum straight into the bladder without deviating more than from three to five degrees to the right or left. I use a simple device, figured in the text as a goniometer (see Fig. 278), to measure the angle between a line connecting the ureteral orifice with the internal orifice of the urethra and the axis of the urethra. The zero line of the goniometer is held in the line of the urethra while the long arm points to the ureteral orifice, when the angle can be read off on the graduated arc. In inflammatory cases the ureter is often drawn markedly to one side.

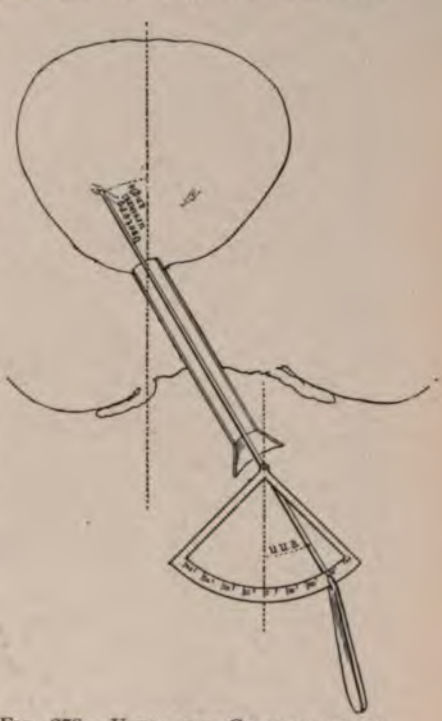


FIG. 278.—USING THE GONIOMETER TO DETERMINE THE ANGLE MADE BY THE AXIS OF THE URETHRA, WITH A LINE DRAWN FROM THE INTERNAL URETHRAL ORIFICE TO THE URETER.

If the abdomen is filled with ascitic fluid, or if there is a tumor wedged in the pelvis, or if inflammatory disease is present, the bladder may not distend enough to allow the ureteral orifices to be seen. In such cases the orifice may be sought in the dorsal position without elevation.

The ureteral orifice is recognized as soon as it comes into the field of the speculum as a fine transverse slit, 2 to 3 mm. long, like a little dark line on the bladder wall, not unlike a water mark in paper. At times it appears more distinct, owing to a slight injection of its borders. Rarely it looks like a fine dark point or a distinct hole. In the knee-chest position a decided eminence, having the form of a truncated cone, marks its site, and the opening is situated on top or on the anterior urethral side of this. I have called this elevation the mons ureteris. In one of my cases there appeared to be two left ureteral orifices, parallel and exactly alike, about 2 mm. apart, but on passing the catheter into the lower one on the edge of the mons instead of going up a ureter, it reappeared in the bladder and the false orifice was found to be a little bridle of mucous tissue, 2 or 3 mm. long and about as wide.

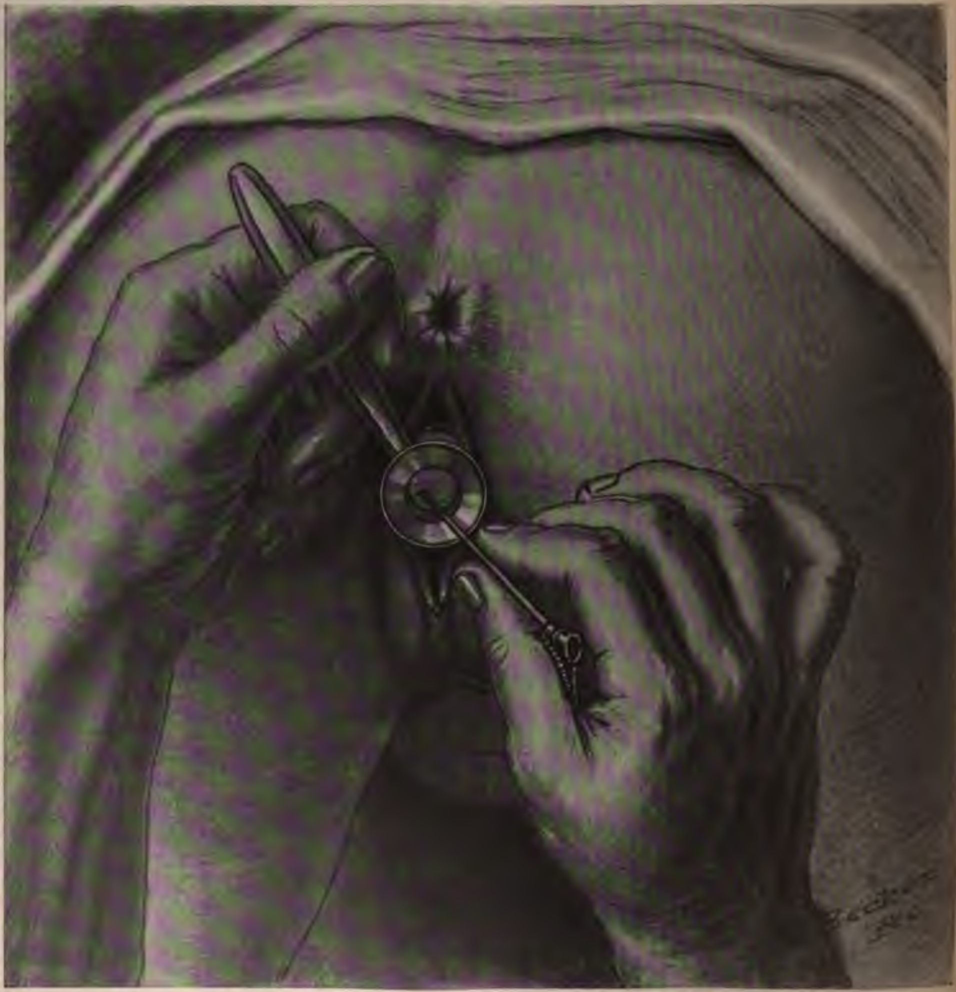


Fig. 279.—Passing a Metal Ureteral Catheter into the Left Ureteral Orifice, which is exposed in the Lumen of the Speculum. The Patient is in the Knee-chest Posture.

When the ureteral orifice is not seen at all after a careful search, it may be found by directing the speculum to the area where it should be, taking care that it is not pushed so far in as to cover it, and then with the searcher systematically and gently running over the whole surface feeling for it. Sooner or later the point catches and enters and the orifice is evident. The searcher upon entering separates the lips of the orifice a little, making them pale and opening up a dark hole about 2 mm. in diameter, especially striking to an onlooker waiting for a demonstration of the possibility of catheterizing the ureter in this way.

Introduction of the Flexible Silk Catheter.—The location of the orifice is carefully noted, and while the speculum is grasped firmly so as to keep it in full view, the sterilized, flexible, silk ureteral catheter projecting a little from its glass tube, is held over the shoulder—in the left hand for the right ureter and in the right hand for the left ureter—and slowly guided up the tube, where its point is engaged in the orifice and pushed on from 10 to 15 cm. (4 to 6 inches).

The end of the catheter must be lubricated by dipping it in a boro-glycerid solution before introduction, and before taking hold of the end of the catheter sterilized rubber finger stalls must be drawn over the thumb and forefinger, to avoid direct contact with the fingers, and so a possible infection of the ureter. If there is any inflammatory process in the bladder, the ureteral orifice must be cleansed with a pledget of cotton held by the mouse-toothed forceps, and the lumen of the speculum must be cleansed in the same way.

In introducing the long renal catheter when the glass tube is not used, the handling of its upper part, which is to lie inside the body, may be avoided by first locating the ureteral orifice and then asking for the catheter. The assistant takes it up by the outer end from the sterilized towel in which it rests and hands it to the operator, who likewise receives it by the outer end, and slowly guides the swinging tip into the speculum and so on up into the ureteral orifice, when it is then easily run off from its stylet and on up the ureter.

When the catheter is in place the speculum is withdrawn, while the operator holds on to the catheter to keep it from being pulled out too. If the catheter is to remain in but a short time the patient may stay in the same position; otherwise she should be carefully turned over on her back or side, avoiding any pull on the catheter.

In many cases where a catheter not larger than 2 or 2.25 mm. is used to wash out the pelvis of the kidney the fluid only distends the pelvis a little and then begins to run down the ureter and back into the bladder outside the catheter. Owing to this circumstance, in cases of catarrhal pyelitis and of pyelo-nephrosis, it is often possible to wash the kidney out thoroughly by keeping up a continuous irrigation for from ten to thirty minutes or longer.

After the renal catheter is inserted the patient lies on the opposite side and a glass catheter is inserted into the bladder. It is well to color the irrigating solution with analine dye to demonstrate its return to the eye. On raising the funnel and letting the fluid run into the kidney the return flow into and out of the bladder is noticed at an interval of from fifteen to seventy five seconds. The end of the catheter is placed in a sterilized test tube to collect the escaping urine. If the tube is left in after the patient is put to bed, it is best held in an auger hole bored at an angle in a block of wood, as shown in Fig. 281.

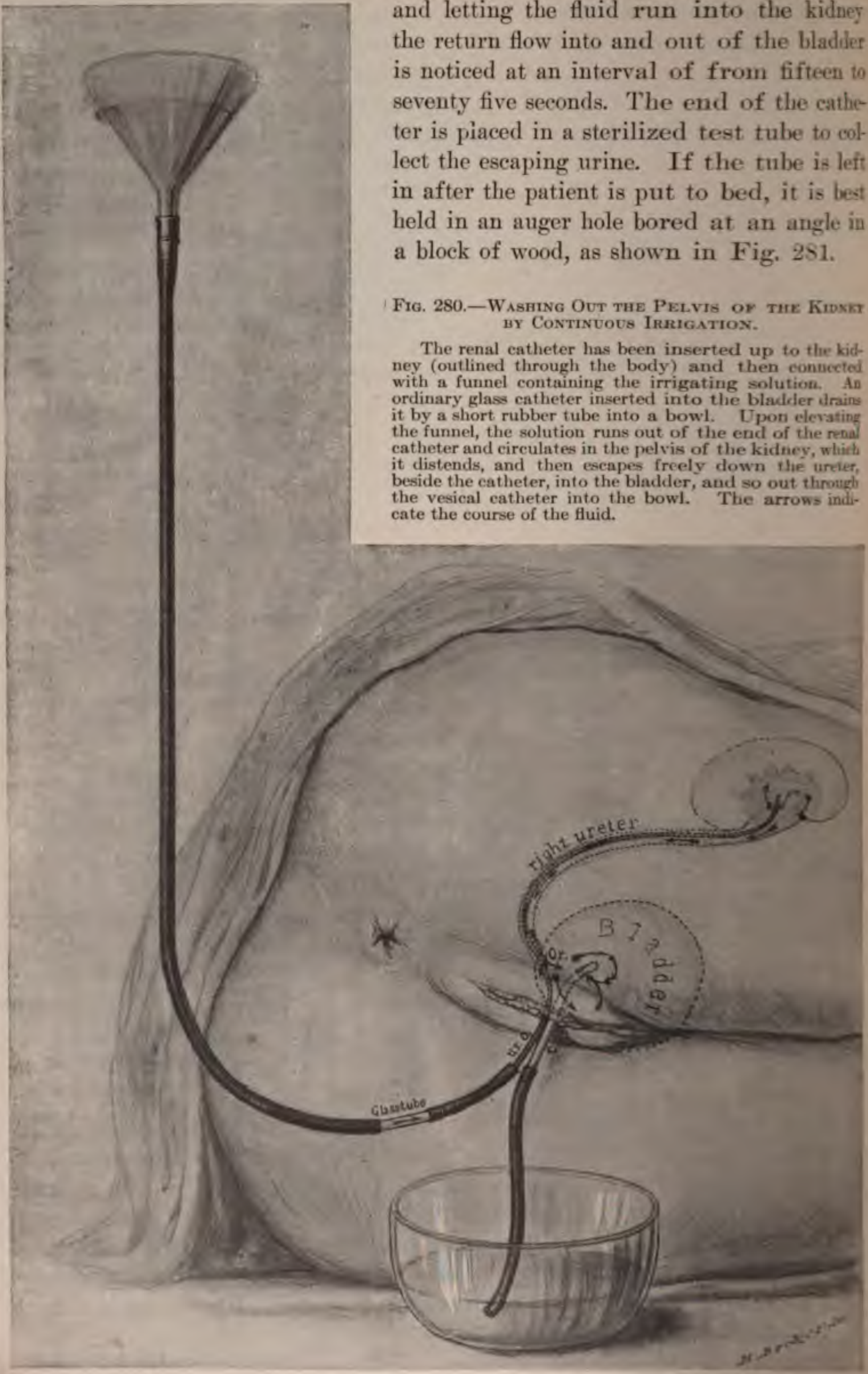


FIG. 280.—WASHING OUT THE PELVIS OF THE KIDNEY BY CONTINUOUS IRRIGATION.

The renal catheter has been inserted up to the kidney (outlined through the body) and then connected with a funnel containing the irrigating solution. An ordinary glass catheter inserted into the bladder drains it by a short rubber tube into a bowl. Upon elevating the funnel, the solution runs out of the end of the renal catheter and circulates in the pelvis of the kidney, which it distends, and then escapes freely down the ureter, beside the catheter, into the bladder, and so out through the vesical catheter into the bowl. The arrows indicate the course of the fluid.

When the short metal catheter with a piece of rubber tubing on the end is inserted into the ureter for the purpose of collecting the urine of one side, it is best to drop a small quantity of a concentrated aniline solution into the bladder so as to have positive evidence that the clear fluid escaping by the catheter is not contaminated by the fluid in the bladder and that the catheter remains in place in the ureter.

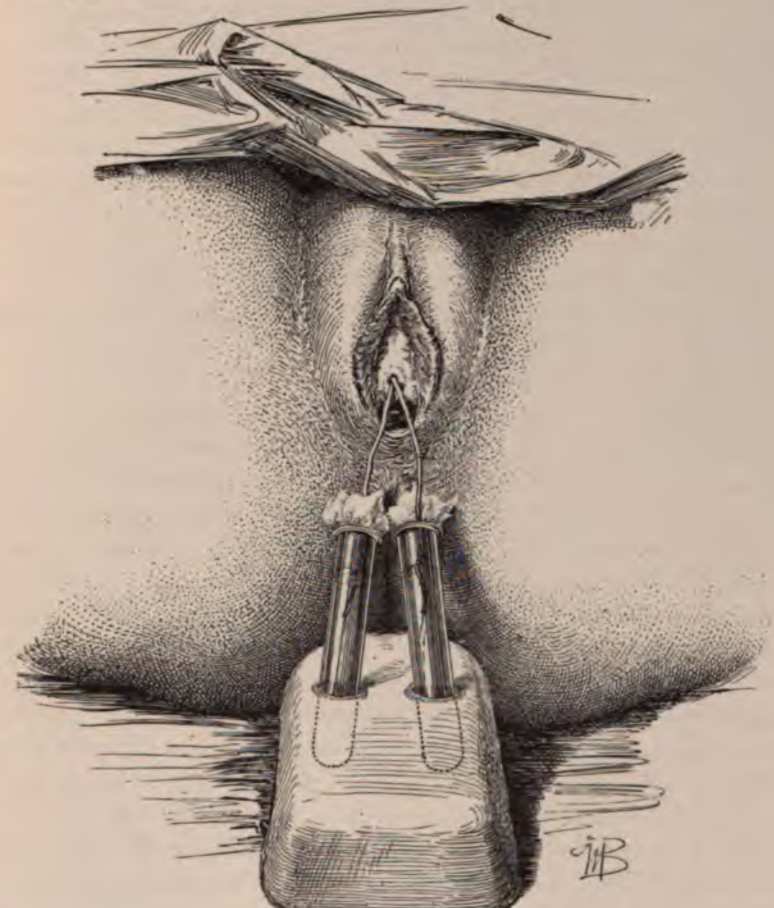


FIG. 281.—CATHETERIZING BOTH URETERS; THE SEPARATED URINES ARE BEING COLLECTED IN TEST TUBES PLUGGED WITH COTTON AND HELD IN A BLOCK.

In making a thorough examination of urine collected directly from the ureter five things must be inquired into:

1. The amount of fluid escaping at once upon the introduction of the catheter.
2. The rate of flow during catheterization.
3. Physical properties of the urine, specific gravity, etc.
4. Chemical properties.
5. Bacteriological condition.

The watch is taken out and the time of introduction noted, so that the rate of secretion may be determined by measuring the amount collected within a definite time.

When both ureters are to be catheterized the speculum is withdrawn and re-inserted beside the first catheter, and the other orifice found and catheterized in like manner.

Another way of securing separated urines from both ureters at the same time is to place one of the larger ureteral catheters in one ureter and then carefully remove all fluid from the bladder with the suction apparatus and pledgets of cotton. The patient lies on her back and the urine drains, say for an hour, through the ureteral catheter into a vessel in the bed. The urine which collects in the bladder during this hour may be assumed to come from the other kidney if it presents different chemical and microscopic characteristics; it is removed either by an ordinary vesical catheter, before taking out the ureteral catheter, or by introducing a speculum and using the suction apparatus. This plan needs further trial and is not available when there is inflammation of the bladder which contaminates the urine accumulating in it.

A method of separating the urines from the right and left ureters without catheterizing the ureters has been devised by Dr. Neumann (*Deutsche med. Wochenschr.*, No. 43, 1897). The patient is seated on the very edge of a table, with her feet on the floor or a stool. An instrument is then inserted which is intended to divide the bladder for a time into right and left halves, and at the same time to provide a free exit for each half, in this way separating the urines. The instrument is constructed like a catheter, 4 cm. long and 1 cm. in diameter, with a vertical partition down the middle; this partition is continued 4 cm. beyond the body of the instrument, and ends in a blunt rounded point, connected with the end by two fine wires on each side. The distal end of the catheter ends in two little tubes, one for each side; on these tubes little graduates are hung to collect the urine. The whole instrument has a gentle curve, like Hegar's cervical dilators.

The urines are separated by first washing the bladder out from one tube through the other, and then introducing the index finger into the vagina and pressing the base of the bladder firmly up against the instrument, which now fits snugly behind the symphysis pubis. The urine escaping from the ureters now flows down the tubes on the right and left sides completely separated.

How to Obtain Uncontaminated Urine.—Sterilized urine, or urine free from any contamination from external sources, may be obtained by covering 3 or 4 cm. (1¼ to 1½ inches) of the outer end of the sterilized ureteral catheter with a protecting rubber sleeve, and then introducing the catheter as described; the sleeve is then removed and another piece of longer sterilized tubing slipped over the end and used to convey the urine into a suitable sterilized glass tube plugged with cotton, resting in a block. To avoid contaminating the end of the catheter by contact with the sides of the speculum, it may be introduced into the bladder loosely covered with a sterilized rubber sleeve, which is pulled off as soon as it is well in; but I prefer simply cleansing the inside of the speculum with a boric acid solution.

It is also possible to obtain uncontaminated urine after introducing the catheter in the ordinary way by boiling the first drop of urine appearing at the end with an alcohol flame held under it; the urine which follows this is then in no danger of contamination by picking up germs at this point.

For a bacteriological examination and cultures it is sufficient in this way to let a few drops fall directly from the end of the catheter on to the slide or into the culture tube. It is always well to test the alkalinity or acidity as the urine escapes.

How to Secure Urine from the Ureter without Using a Ureteral Catheter.—Sometimes there are serious objections to passing a catheter into a sound ureter; when, for example, the bladder is extensively inflamed, the examiner will hesitate, on account of the risk of opening up the ureter and of the dangers attendant upon the slight trauma under such circumstances. But it is almost always possible to get enough urine for a microscopic and chemical examination without even touching the ureteral orifice. This is done by putting the patient in the knee-chest position, exposing a ureteral orifice, wiping it off, and then holding the end of the speculum close up under it until a jet of urine escapes; the drop is caught in the lumen of the speculum and runs down its side on to the outer lip, where it may be taken at once on to a slide and examined or collected in a minim graduate. The miscroscopic examination in this way of a drop or two may be just as satisfactory as a large quantity secured by the ureteral catheter (see *Twentieth Cent. Prac. Med.*, vol. i, 1895, p. 690).

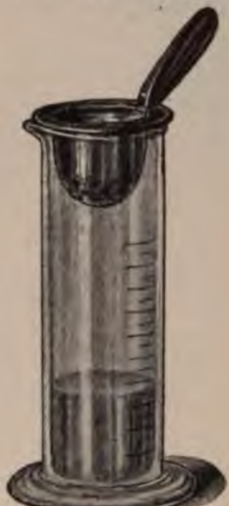


FIG. 282.—SIEVE AND GRADUATE FOR FILTERING AND COLLECTING A FEW DROPS OF URINE CAUGHT UP ON COTTON FROM THE URETERAL ORIFICE, THROUGH THE SPECULUM, WITHOUT CATHETERIZING THE URETER.

I have had a speculum made for this special purpose (see Fig. 225, p. 365) with the end cut off obliquely to fit in better under the orifice in the knee-chest position. (See also Fig. 283.)

Catheterization of the Ureters without Elevation of the Pelvis and without Atmospheric Distention of the Bladder.—Under certain circumstances, when it is awkward, or when it consumes too much time to place the patient in the knee-chest position and to elevate the hips on cushions, I am in the habit of introducing the catheter in the following simple manner, without elevation, or atmospheric distention of the bladder:

The patient lies on her back on a flat table, with thighs well drawn up on the body, and the bladder is emptied. The No. 9 or 10 cystoscope is now introduced, its outer end strongly elevated, and the inner end turned toward the right or left side of the base of the bladder. The head mirror is now turned so as to illuminate the portion of the wall of the bladder at the end of the speculum. The speculum is now withdrawn as far as the urethral orifice, to locate its position, and then pushed in again and turned to one side with the idea of bringing the ureteral orifice at once within the lumen of the speculum. Sometimes it can be seen immediately, even through a little layer of clear urine; at other times it is necessary to keep the speculum against the bladder wall, and then, after drying out the few drops of urine in it, to find the ureteral orifice by gliding the instrument over the vesical mucosa. Any depression resembling the mouth of the ureter is first tested with the searcher, and then, if it is found, the catheter is pushed in. By introducing the flexible catheters in this way just before a vaginal or abdominal hysterectomy the ureter is converted into a cord easily felt throughout the operation.

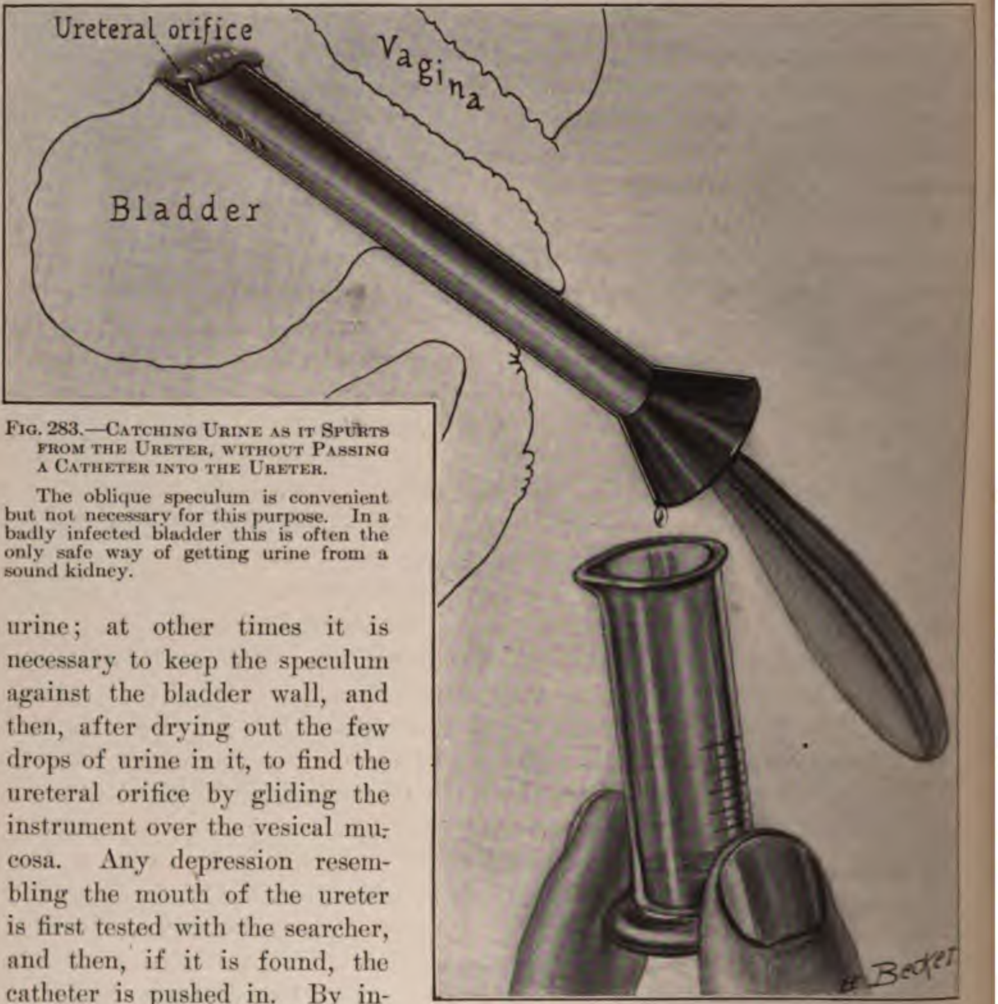


Fig. 283.—Catching Urine as it Spurts from the Ureter, without Passing a Catheter into the Ureter.

The oblique speculum is convenient but not necessary for this purpose. In a badly infected bladder this is often the only safe way of getting urine from a sound kidney.

It not infrequently happens that a patient with carcinoma of the cervix, is so heavy that she can not be put into the knee-chest posture with the limited assistance at the command of the operator, or else that she is so feeble that the operator feels unwilling to lose the amount of time necessary to change her position in order to find the ureteral orifices for catheterization. Under these circumstances I have often resorted to the method just described with perfect satisfaction. It will, however, hardly be possible for one not thoroughly used to the simpler way of catheterizing the ureters in the knee-chest posture, and therefore familiar with the exact location of their vesical orifices, to find them in the dorsal position with a collapsed bladder.

Points to be Observed in Securing Separated Urines.—I use the word urines in the plural advisedly, to make a distinction, hitherto impossible, between the mixed urine in the bladder from both sides and that from each kidney separately before mixing.

The purpose of the examination is to estimate correctly the status of each kidney by determining (1) its working coefficient as estimated by the amount of urea being secreted; (2) the existence of various morbid products, such as casts, albumin, pus, and bacteria.

To reach accurate conclusions, the following points should be observed in catheterizing both ureters:

1. The exact time of introduction of each catheter is noted. It is well to attach the note to the catheter on a card.

2. The time of withdrawal is noted and also written on the card, giving the exact duration of the flow.

3. The exact amount of secretion collected in the test tube is noted.

4. It is well to compare the rate of secretion, determined by noting the amount of flow in a given unit of time, say from five to fifteen minutes or longer, with the entire amount passed in the twelve hours during which the examination is made. If the amount secured is too small or too large the error may be rectified in this way. A nervous patient, for example, will sometimes pass an excessive amount through the catheter.

5. An analysis of each urine is made, investigating its physical, chemical, microscopical, and bacteriological characters. Especial attention must be paid to the urea as the most important representative of the physiological activity of the kidney. It is better to keep a book of charts for recording each analysis under some such plan as shown on page 500.

Sounding the Ureters.—Sounds are introduced into the ureters to find a stricture or an obstruction, to dilate a stricture, and to convert the soft ureter into a firm resisting cord, easily found and kept under the fingers during a pelvic operation.

In most instances the catheters serve the purpose of bougies as well or better than a solid instrument. The catheter, for example, gives evidence of the passage of a stricture by the difficulty of entrance and by the bite of the stricture, as well as by an immediate gush of urine; the long, flexible silk catheters serve just as well to splint the ureter and mark out its course to prevent injury during an operation. The catheter, however, can not so well detect and estimate the character of resistance, and the force used in overcoming it

ANALYSIS OF SEPARATED URINES.

Name, *Date,*

Diagnosis,

Right or left ureter catheterized,

Size of catheter used,

Time of insertion of catheter,

Time of withdrawal of catheter,

Amount of urine secured,

Estimated average amount in twenty-four hours,

Appearance of urine on withdrawal,

Reaction,

Sediment,

Specific gravity,

Albumin,

Urea,

Microscopic examination,

Bacteria, cover-slip and cultures,

can not be so well gauged. For these purposes I use hard rubber bougies 30 cm. (12 inches) long and 2 mm. in diameter for the pelvic portion, and 50 cm. (20 inches) long for the entire ureter and pelvis of the kidney.

These bougies are smooth and flexible, and easily follow the course of the ureter. The ureteral orifice is exposed as for catheterization, and the point of the bougie engaged. By pressing on one side or the other of the speculum the end may be brought to bear directly upon the ureteral orifice and slipped in.

By a gentle forward movement it is carried onward and upward toward the kidney, easily guided by the ureter and taking all its curves.

Catheterizing the Pelvis of the Kidney.—The pelvis of the kidney can be catheterized by means of long, flexible silk catheters.

To introduce the renal catheter, the hands are carefully washed and sterilized, the ureteral orifice exposed, and the catheter, taken from the refrigerator or stiffened with a stylet, is coated with boro-glyceride at the end and slipped through the speculum and pushed on until its point is engaged in the ureter. The long outer end of the catheter, wrapped in a piece of sterilized gauze, or still lying in the sterilized towel, out of which it is drawn as it is introduced, must hang over the shoulder. The rate of introduction should be slow, 2 or 3 cm. at a time, and the examiner should take care to keep the end of the speculum close to the ureteral orifice, and watch to see that the catheter does not kink in the bladder or speculum. The patient may have no sensation at all as the catheter goes in, or may be only conscious as the end touches the upper margin of the pelvis of the kidney.

When from 32 to 37 cm. (13 to 15 inches) have been pushed in beyond the external urethral orifice the end will lie in the upper part of the renal pelvis.

If the catheter is soft and has to be braced by a stylet, this must not reach quite to the end, and as soon as a few centimeters of the catheter are engaged in the ureter the stylet is pulled out for the same distance, after which the catheter is stripped off from the stylet and pushed on up the ureter into the kidney.

Normally there is but little urine collected in the pelvis of the kidney, and it is necessary to wait a while for the catheter to fill and begin to discharge the droplets. The respiratory movements may be seen in the play of the drop to and fro as it hangs from the end of the catheter. When there is a stricture in the ureter or at the pelvis of the kidney there is an accumulation of urine or pus within the pelvis. The renal catheter relieves this retention by drawing off the fluid and discovers lesser grades of hydronephrosis and pyonephrosis which have hitherto escaped attention. I estimate the degree of hydronephrosis by measuring the exact amount of fluid discharged in a steady stream or by continuous dropping with the catheter held down so as to act as a siphon. If the catheter is a small one and it takes a long time to empty the sac, I then allow half a cubic centimeter per minute for the activity of the kidney during the time of evacuation. As soon as the flow begins to come at intervals it is evident that this is dependent on the present secretory activity of the kidney, and the accumulated urine has been exhausted.

Asepsis.—The whole technique of the examination and exploration of the ureters must be aseptically conducted. The danger from introducing septic material directly into a ureter is sufficiently obvious, and is illustrated by numerous examples of a fatal infection ascending from the urethra up to the kidney. If an infection of the urethra or bladder can spread in this way, it goes without saying that an infection introduced into the ureter will also spread.

The various manipulations ought to be conducted with a care in the aseptic technique equal to that of any surgical procedure, so that there is no excuse for any ill sequel from a simple examination in a healthy case.

The aseptic technique is divided into two stages: (1) Care of the instruments; (2) care during their introduction.

The silk catheters must be sterilized before using by boiling two minutes in plain water, and immediately after every use they must be washed with hot water, boiled for two minutes in pure water, and laid away on a sterilized towel until perfectly dry inside and out. They may also be washed out with a saturated solution of oxalic acid. They are then put singly, or several together in a long sterile glass tube, plugged at each end with cotton. The metal catheters are sterilized in the same way as other metal instruments, by boiling five minutes in the soda solution (see Chapter I).

In introducing the catheters the greatest care is necessary at every step to avoid contamination by the assistant, the speculum, the bladder wall, or the fingers of the examiner.

The lumen of the speculum and the ureteral orifice are cleansed with a pledget of cotton saturated with a boric acid solution, held by the mouse-toothed forceps.

The metal catheter is held by its outer end, avoiding at all times touching the end that is to go into the ureter; it is then guided up the speculum and introduced. To introduce the flexible ureteral and renal catheters, the end is pushed a little way beyond the glass tube and dipped in boro-glycerid, the glass tube is then rested on the examiner's shoulder. He now takes hold of it with thumb and forefinger covered with sterilized rubber finger stalls, draws it out of the tube, and guides it on into the ureter. By using these simple precautions all risk is avoided.

Ureteral Fever.—I have seen ureteral fever following the introduction of the ureteral catheter in four cases. In each of these cases the upper urinary tract was already infected, and the urine contained pus coming from the pelvis of the kidney.

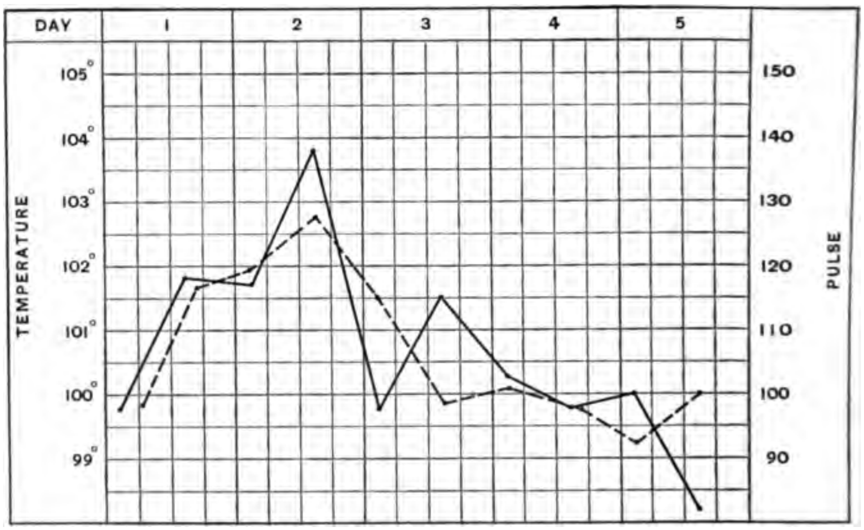


FIG. 284.—COMPOSITE TEMPERATURE AND PULSE CHART OF TWO CASES OF URETERAL FEVER PRODUCED BY INSTRUMENTATION.

One patient had a stricture at the vesical end of the ureter and a dilated pyoureter and pyelitis. On two occasions, while washing out the ureter and kidney, in a case under treatment for some time without any change in the technique, the introduction of the catheter was followed by a chill and fever, with an elevation of the temperature as high as 104° F. The pulse increased in rapidity in proportion to the fever, the face became flushed, and the patient was restless and had severe headache. From the second day on to the fourth or fifth day the temperature declined to normal. During the attack chilly sensations were repeated daily, and there was a decided tenderness over the course of the catheterized ureter.

In another case the attack began with a decided chill on the evening after the irrigation, which was practiced through a metal catheter injecting a bichloride of mercury solution (1–50,000). The patient complained of pain along the course of the ureter and in the back, and had a hot flushed face with headache and malaise. The temperature was highest on the second day, reaching 103° F., and declined to normal on the fourth day. In a second attack, following treatment four days later, there was malaise and a temperature of 101.8° F. on the second day, but no chill. The temperature became normal on the third day. The other two cases were similar. In no case did any harm result. I give in the text a composite chart constructed by combining the two cases mentioned.

CONGENITAL AFFECTIONS OF THE URETER.

Anomalies of the ureter are rare, and especially rare are those which produce disturbance of function. In their extreme forms ureteral malformations are found oftenest in non-viable fetal monstrosities; for example, one ureter has been found entirely wanting, while the other was converted into a fibrous cord. (Förster, "Misbildungen," Plate XXIII, Fig. 19.)

Double Ureter.—A double ureter is the commonest of all anomalies, and occurs in several forms; it may either start at the kidney from two distinct pelves, and then unite at some point below to form a single canal, or it may continue double all the way down, and end by two orifices in the bladder, one behind the other. This condition has been found on both sides in the same patient. The ureter starting from the upper pelvis of the kidney is the longest and crosses its fellow to end nearest the urethra. The duplication may, on the other hand, be due to a split which begins at any point below the normal renal pelvis, and the ureter continues double all the way to the bladder; or again the two canals may fuse at any point on the way down.

An interesting case of complete duplication of the left ureter occurred in one of my patients and was reported by Dr. Otto Ramsay (*Johns Hopkins Hospital Bulletin*, November–December, 1896). The patient (A. W., 4154), forty-five years of age, was admitted to the ward with an inoperable cancer of the cervix and died soon after admission. Autopsy (No. 813, June 22, 1896).

Anatomical diagnosis: Sloughing carcinoma of the uterus, perforation into the rectum. Involvement of the uterus, with hydroureter and slight hydronephrosis.

The two left ureters begin at the hilum of the kidney in two separate pelves, and run down into the pelvis side by side, closely bound together, but separate to the bladder, which they enter by distinct orifices 1.5 cm. apart. They are dilated from the point where they are involved in the cancerous growth near the cervix, all the way up to the kidney. Each one is about the size of the little finger and has clear contents. They show a marked contraction where they pass through the growth. The drawing on page 534 well illustrates the condition (see Fig. 290).

Such forms of duplicature have no pathological significance. Two other forms of malformation, however, are of the highest importance; these are the ectopic ureteral orifice and the dilatation of an occluded ureter.

Ectopic Ureteral Orifice.—An ectopic ureteral orifice is one located in the vagina, or in the urethra at the external urethral meatus, or under the hood of the clitoris.

The one common symptom observed in such cases is a persistent leakage of urine, noted from childhood up, but varying in amount at different times as measured by the napkins worn. In spite of this constant discharge, the patient empties her bladder at regular intervals, and the abnormal flow continues as active after micturition as before it. The abnormally displaced orifice may be either the only one connected with the kidney, or a supernumerary orifice, the other opening normally into the bladder. The practical importance of distinguishing between these two allied and, to a superficial examination, similar conditions is evident.

Diagnosis.—In incontinence of urine not due to gross and easily demonstrable lesion, such as a vesico-vaginal or uretero-vaginal fistula, the inquiry into the cause must be made in a careful and orderly manner in order to discover cases of this kind.

The first question to be answered is whether the involuntary discharge of urine comes through the urethra, and if it does whether it is simply due to a breaking down of the sphincter fibers at the neck of the bladder, or whether there is some extraordinary channel of communication between the ureters or bladder and the genital tract.

If the patient is a virgin, or has never borne children, and if her bladder has not been subjected to any manipulative interference, and if the disease has existed from earliest childhood, the presumption is at once in favor of a congenital malformation; if, on further investigation, a certain quantity of urine is found accumulated within the vagina after lying down for a while, a vaginal orifice of discharge may be looked for. By drying out the vagina and placing in it dry pledgets of absorbent cotton, and at the same time filling the vulvar cleft with cotton, and waiting a few minutes, it will be easy to determine the fact of a leakage, by noticing the spots on the cotton, where a little urine has accumulated, and this will also approximately fix the position of the opening. By injecting the bladder with an aniline or sterilized milk solution, its independence of this viscus will be demonstrated. A prolonged careful inspection of the area indicated by the spot of urine on the cotton will reveal the minute orifice through which intermittent discharges of urine escape. If the discharge comes from the urethra, a careful urethroscopic examination must be made of the entire tract from the internal sphincter down to its external orifice by withdrawing the urethroscope millimeter by millimeter, constantly watching the funnel-shaped figure of the urethra at the end of the speculum for any small opening or jet of urine.

On finding the orifice the questions now to be answered are these:

1. Is the abnormal opening a ureteral orifice?

2. On which side is it located—that is to say, to which kidney does it belong?

3. Is there a single or a double ureter? If double, is there a normal opening into the bladder?

4. If double, does it continue so all the way up to the kidney, or does it unite with its fellow at some point above the bladder?

5. If double all the way up, do both ureters enter a common pelvis, or have they separate pelves?

First, it is a ureteral orifice if, when the bladder is injected with a colored solution, none of the fluid escapes by the opening, demonstrating its independence, and if, in spite of the passage of urine at regular intervals from the bladder, little jets of urine are seen coming from the orifice, with intermissions not longer than a few seconds.

Second, the assurance that the opening is ureteral is given, and also the answer to the question on which side it is located, and therefore to which kidney it belongs, by passing a long renal bougie through the opening up into the pelvis of the kidney from 25 to 30 cm. or more, and then by observing to which side of the cervix uteri the bougie turns, as well as by palpating the bougie through the vagina and rectum.

The third question, whether it is a single or double ureter, is answered by placing the patient in the knee-chest position, introducing a No. 10 vesical speculum, and looking for the ureteral orifices within the bladder. If the orifices are found on both sides in normal position, it is evident that the ureter is supernumerary or split.

The fourth question, whether a double ureter continues double all the way up to the kidney, may, I think, be answered in the following way: I would pass a catheter, 2.5 mm. in diameter, large enough to fill the lumen of the abnormal ureter, all the way up to the pelvis of the kidney. I would then introduce a renal catheter into the normal vesical orifice of the same side and push it up. If the two ureters unite into one a short distance above the bladder, or at some point in the abdomen below the kidney, I should expect the second catheter to be stopped short in its course upon striking the first.

The catheters could now be withdrawn after carefully noting the exact distance to which each had been introduced, and by laying them together on a sheet of white paper in a similar position a tracing of the form of the ureter could be made. To make sure of the diagnosis it would then be well to reverse the procedure by introducing a long catheter up into the kidney through the vesical orifice of the ureter, and then pushing up another catheter through the abnormal orifice, until it is stopped by the first catheter. The exact distances to which the catheters have been introduced is again noted, they are withdrawn, and the ureteral situation reconstructed a second time on paper: if the two drawings correspond, the diagnosis will be confirmed.

To determine whether the ureter is double throughout, and if double, whether the kidney has one or two pelves, the following plan will be sufficient: A renal catheter is passed through each ureter up to the renal pelvis and a sterilized aniline solution is injected into one, when, if there is a communication between the pelves, the colored fluid will immediately flow from the other; if there is no communication, it will simply be returned, while the other side discharges clear urine.

These various points in diagnosis are of practical importance in determining the nature of the operation to be performed.

When the opening is at the urethral orifice, the anterior wall of the vagina may present a characteristic, prominent, curved ridge, which covers the ureter, as in the case of Dr. F. H. Davenport, of Boston (*Trans. Amer. Gyn. Soc.*, 1890, p. 343), in which the orifice was in the posterior wall of the external urethral orifice. W. H. Baker's case opened similarly about two lines to the left of and below the urethra (*Boston Med. and Surg. Jour.*, Dec., 1878). It was not determined in either of these cases whether or not the ureter was double; but this could now be done, either by examining the orifices in the bladder cystoscopically, or by passing a renal catheter up to the kidney pelvis, injecting an aniline solution, and noting whether the urine in the bladder is colored.

Erlach reported a case before the Vienna gynecological society, December 4, 1888, in which he found post mortem a right ureter double throughout, each ureter starting in a separate pelvis above. One of the ureters opened naturally into the bladder and the other into the urethra just below the internal orifice. In spite of this, there was no history of incontinence.

A case of congenital anomaly of the ureter has been observed by Baum, in which the supernumerary opening was close to the external urethral orifice. The normal orifice was seen upon opening the bladder from above.

In a case of Massari (*Wien. med. Wochenschr.*, 1879, No. 33) a child four years old, with a preternatural vaginal anus, suffered from constant leakage of urine, the cause of which was only explained post mortem, when the kidneys were found to be fused across the vertebral column. The right ureter was normal throughout, but the left one had no vesical orifice; instead, it passed the bladder in its course and discharged by a minute orifice just under the prepuce of the clitoris. The vagina was double and the uterus normal.

Treatment.—The object of the treatment is to get rid of the constant leakage by turning the urine into the bladder.

Two plans in general have been tried to effect this. First, by dissecting out the extremity of the ureter from its bed and turning it into the bladder, and, second, by making a suprapubic incision into the bladder and then opening the ureter beneath the base of the bladder and establishing a communication between the two, after which the distal end of the ureter beyond the opening may be ligated. The suprapubic incision is closed at the end of the operation.

In case the ureter is double with a single renal pelvis above, it would be proper to try the plan of ligating the abnormal ureter at any point in its course where it could most conveniently be laid bare; the operator might introduce a flexible renal catheter, and, using this as a guide, incise the vaginal wall somewhere from 2 to 3 cm. beyond the abnormal orifice, laying bare the ureter in its course. It should then be carefully dissected out from the surrounding tissues and freed on all sides sufficiently to allow a ligature to be placed about it. It may then be ligated with silkworm gut or fine silk, dropped, and the vaginal incision closed over it.

According to the plans pursued by Baker and Davenport, the ureter is dissected out from its external orifice back to the base of the bladder by splitting the vaginal wall, exposing the abnormal canal, and carefully freeing it on all sides from the cellular attachments. When it has been freed up to a point under the base of the bladder corresponding in position to that of the normal ureteral orifice, an incision is made through the vesico-vaginal septum into the bladder, a little less than a centimeter in length. The end of the ureter which has been dissected out, is now cut off, and the new orifice slit up for about 6 mm. to make a larger opening. The end is then turned into the bladder through the opening, which is closed by two or three silkworm gut sutures extending through from the vaginal surface to the vesical mucosa. The uppermost suture is made to include the muscular coats of the ureter at a point about on a level with its opening into the bladder. Another fine suture below this penetrates the vesico-vaginal septum for a short distance and catches the ureteral coats again. The ureter being fixed by the two sutures, the remainder of the vaginal incision from which the ureter has been dissected is closed by interrupted sutures.

This was done by Dr. W. H. Maxson, of St. Helena, Cal. (*Med. News*, March 21, 1896, p. 323), who operated upon a young woman twenty-two years old for an incontinence of urine dating from her earliest recollection. He found the orifice of the left ureter about a quarter of an inch within the external urethral orifice. At the operation the ureter was dissected out through the vagina for three inches and a half, and drawn through a small opening made in the base of the bladder close by, after cutting off an inch and a half of the lower end. The ureter was then stitched to the bladder wall with catgut and the vaginal incision closed. A complete recovery of function ensued.

It is important, as a preliminary precaution, to determine by a cystoscopic examination whether the ureter is single or double. If it is double, a bougie must be placed in the normal ureter opening into the bladder, so that in transplanting the abnormal orifice, the normal one will not be cut nor included in the sutures.

The plan of establishing a communication between the abnormal ureter and the bladder by a suprapubic incision in the bladder was adopted in Baum's case to avoid dilating the vaginal orifice in a girl eighteen years of age. The right ureter, discharging close to the urethral orifice by a fine opening, was greatly dilated in the neighborhood of the bladder. The base of the bladder was incised through a suprapubic incision and the dilated ureteral sac opened from above. A piece of the sac about a centimeter in diameter was now excised and the edges of the incision stitched together. The part of the ureter beyond this new opening was now ligated. A portion of the abdominal incision was closed with suture, and the prevesical space drained with iodoform gauze. After this operation urine passed naturally. The patient passed a urinary concretion five months later and suffered from a hernia.

Cystic Dilatation of an Occluded Ureter.—A rare, but practically important anomaly of the ureter is that in which the lower end has failed to communicate either with the bladder or with any part of the genital tract, and remains occluded. If this forms the only avenue of discharge for the corresponding kidney or part of the kidney, complete atrophy of the organ depending upon it is a necessary consequence.

Where the terminus of the ureter is under the base of the bladder, and the lower end is dilated into a spherical or ovoid cyst, this has been seen projecting into the bladder, forming a prominent rounded tumor, occupying one side of the base, as in F. Tangl's case, where the left ureter was affected in a woman sixty-seven years of age, and ended in a sac-like projection into the bladder. The kidney of the same side was extremely atrophic and displaced downward. The right kidney was in a state of chronic interstitial nephritis. The tendency of such anomalies to be associated with other malformations was shown by the fact that the patient had a uterus bilocularis unicollis.

A similar case to this was that of Kolisko, where the right ureter was double throughout. The abnormal ureter began in a separate pelvis in the upper part of the kidney which was atrophied, and in its passage downward crossed its fellow and ended below the orifice of the normal ureter in a sac-like dilatation, which projected into the lumen of the bladder and extended down into the urethra. This tract had thick muscular walls. It was quite evident in this case that the kidney was a fused one, and that the maldeveloped ureter belonged to the upper kidney.

One of the most remarkable cases of cystic dilatation of the lower end of the ureter is that of Dr. E. G. Orthmann, of Düsseldorf, in which the cyst presented the characteristics of a vaginal cyst. The patient was twenty-seven years old, and presented a circumscribed cystic tumor of the anterior vaginal wall, which she thought was a prolapse of the uterus. This gradually kept increasing in size and was associated with drawing pains in the left side, extending around into the small of the back. The tumor was elastic and circumscribed; it occupied the lower third of the vagina down to within a finger's breadth of the external urethral orifice. It could be pushed back, but returned on the least straining. Careful examination showed that it had no connection with the urethra or bladder. At the operation the thick walls of the tumor were dissected out up to a long pedicle on the left side which was bared from 8 to 10 cm. (3 to 4 inches), when it became evident, from the way in which the tumor emptied itself upward, that there was a communication with the ureter above. The pedicle was tied and cut, after which it retracted into the cellular tissue out of sight. The wound was closed with catgut and the convalescence was undisturbed.

In another group of cases of ureteral anomalies the lower end of the ureter may end in a blind pit without any dilatation. In these cases the kidney of that side is entirely absent or atrophic. When the ureter comes from a separate portion of the kidney by a pelvis of its own the atrophy may be limited to this part. Such is the case reported by F. Tangl (*Virchow's Archiv*, Bd. cviii, p. 414), in a patient sixty-five years old, with extreme atrophy of the left kidney and a double right ureter which united below and ended in a blind canal, recognized as Gartner's duct, in the anterior vaginal wall. The right kidney was affected with chronic interstitial nephritis. There was a bilocular uterus with one cervix.

Haller (*Deut. Arch. für klin. Med.*, Bd. v, Heft 2) and Weigert (*Virchow's Archiv*, No. 70, p. 490) report cases where, with complete duplication of the ureter and pelvis, one of the ureters ended blindly in the bladder wall, causing in this way a partial hydronephrosis.

Congenital Flexure of the Ureter.—A case of congenital flexure of the right ureter with extreme hydronephrosis is described by Weigert. The large kidney extended 3 cm. (1¼ inches) beyond the middle line. The right ureter pursued a normal course from the bladder to a point 21 cm. (8½ inches) above it, where it reached the lower border of the tumor. At this point it bent suddenly to the left, forming a sharp kink, beyond which there was considerable enlargement of the lumen. It extended from this point to the left border of the tumor, into which it merged. The lower margin of the dilated ureter curved around on to its left side, while at the upper margin there was a second sharp flexure. There was no thickening or evidence of inflammation, and after releasing the flexure the fluid easily escaped.

DISEASES OF THE URETER.

Ureteritis and Periureteritis.—Ureteritis and periureteritis are found associated with a variety of urinary diseases. In ureteritis there is an inflammation and thickening of the coats of the ureter, the disease beginning with the mucous coat which is most exposed.

Periureteritis, on the other hand, is an inflammatory affection involving the cellular tissue in which the ureter lies throughout its whole course from renal pelvis to bladder. The peritoneum overlying the ureter may also be involved by contiguity. Periureteritis often arises in an affection of the cellular tissue, extending upward from the vaginal vault. I have seen two such cases following the division of the ureter in a vaginal hysterectomy, leaving a fistulous opening at the vault of the vagina. In one case I opened the abdomen some weeks after the operation, to transplant the fistulous orifice into the bladder, and found the cellular tissue surrounding the ureter on that side dense and rigid from the vaginal vault up to the brim of the pelvis. The structures were so hard and immobile that any attempt to dissect the ureter out of its bed and lift it up could not even be considered. A periureteritis due to an inflammation extending from the interior of the ureter outward is rare; I have not yet encountered it in any case.

The causes of ureteritis are threefold: (1) By extension of the disease upward from the bladder; (2) by extension of renal disease downward into the ureter; or (3) the inflammation may originate from some cause located in the ureter itself, such as a calculus. The first and second causes are the most frequent.

In ureteritis due to calculus the evidences of the disease are found in a thickening and contraction of all the ureteral coats, forming a stricture below the stone lodged in it. When several stones are lodged in one ureter, a series of strictures is found with dilatation above each.

The most rational classification of the various forms of ureteritis induced by vesical or renal disease is that which depends upon the special exciting cause. We may thus distinguish a ureteritis due to streptococcus or staphylococcus infection, ureteritis due to gonorrheal infection, and finally a tubercular ureteritis. Of these forms, the first three commonly originate in the lower urinary tract, infecting first the urethra and bladder, and then the ureter through the continuity of mucous surfaces, while the tubercular disease more commonly starts in the kidney and affects the ureter from above downward.

It is remarkable how frequently extensive inflammatory lesions are found, either in the bladder or in the kidney, without any marked participation of the ureter, although it is directly continuous with the bladder below, and constantly bathed with the infectious renal discharges from above.

Another and rare form of inflammation affecting the ureter and pelvis of the kidney is cystic ureteritis and pyelitis, characterized by the formation of little cysts the size of a hemp seed, or smaller, projecting from the mucous surface and containing a thin watery or tenacious fluid. These cysts are more abundant in the upper part of the ureter, and probably originate in the sparse glands or crypts in the mucosa.

The symptoms common to the various forms of ureteritis arise either from the inflamed ureter itself, or from the interference with function resulting from the inflammation. Owing to the fact that the ureteritis is always secondary and is usually simply an extension of grave renal or cystic disease, its own peculiar symptoms are often masked. This is particularly the case in acute forms resulting from a severe infectious process extending rapidly from the bladder up to the kidney.

In chronic ureteritis the most marked symptoms are the pain localized on one side and extending up into the flank, with frequent and painful micturition. Pus is always found in the urine, and sometimes blood.

The prognosis in the acute forms, while depending somewhat upon the involvement of the ureter, will be better guided by the condition of the bladder or kidney which can be investigated and estimated, while that of the ureter can only be surmised. In the chronic forms the prognosis depends entirely upon the cause; the gonorrheal ureteritis tends to form stricture just as in the urethra. When not actively treated, the tendency is to run a long course, often extending through a series of years. It is important to note that, in spite of extensive involvement of the ureter, the function of the kidney is rarely entirely lost.

The diagnosis of ureteritis is not difficult to make with the direct means of investigation at our command. The subjective symptoms, the most characteristic of which is pain along the ureter, often so closely simulate cystitis that a differentiation can not be made by symptoms alone.

Infallible diagnostic points are found by making a digital examination. The bladder and rectum must first be emptied, and then upon introducing the finger into the vagina and palpating the antero-lateral vaginal wall in its upper part, a large, thick, exquisitely tender cord is found sweeping upward to the vaginal vault and disappearing at the side of the cervix under the base of the broad ligament. It is often nodular, and when felt for the first time in the vaginal vault it invariably creates the impression that it is an adherent ovary or tube. I have known inflamed ureters to be mistaken for ovaries in this way. The pain provoked by the examination is usually so great that an anesthetic is necessary to outline thoroughly the structures. The thickened ureter is often movable in the cellular tissue; by introducing the finger into the rectum it may be traced over the sciatic notch and on up toward the brim of the pelvis, where it is found lying close to the internal iliac artery. Upon palpating through the abdominal wall, down upon the pelvic brim, at a point 3 cm. (1¼ inches) to the right or left of the promontory of the sacrum and a little below it, the patient will complain of pain, and, if the abdominal walls are unusually thin, the thickened ureter may be felt rolling under the fingers. If the umbilical ring is relaxed the ureter can be felt through it with the utmost distinctness. Upon continuing the palpation upward in the course of the ureter, it can be traced by the pain elicited when the pressure is made directly over it. Through an open abdominal incision, by preference in the semilunar line, the thickened left ureter may readily be found at its point of transit from the abdomen into the pelvis, by lifting up the sigmoid flexure to the right and exposing the ureter just beneath the peritoneum, as it crosses the common iliac artery beside the ovarian vessels. On the right side the ureter may be exposed by lifting up the head of the colon and drawing it to the right.

By making a cystoscopic examination when the bladder is distended with air, the ureteral orifice of the affected side will often be found the center of an area of intense injection, situated on a truncate cone, sometimes surrounded by papillary eminences, and not infrequently markedly everted. If the orifice is watched for a time, turbulent or purulent urine may be seen escaping.

By means of a catheter, urine may be collected from an infected ureter, and if the catheter is not contaminated in the introduction, a bacteriological examination of the urine obtained will often reveal the cause of the inflammatory trouble, whether due to tubercle bacillus, gonococcus, or streptococcus.

Treatment.—As we can do nothing directly to the ureter in an acute inflammatory condition which will be beneficial, the treatment of this form of ureteritis is purely expectant, and devoted to the associated disease in the bladder or kidney.

In its chronic form the treatment must vary according to the extent of the disease, and to the changes it has produced in the kidney. If the result of the ureteritis has been simply to thicken the coats of the ureter and form an obstacle to the downward passage of urine, the urinary channel above such an obstacle will be dilated with urine or pus, and in all cases, before any more radical measures to relieve the obstruction are adopted, a renal catheter must be passed, in order to determine the degree of stricture, estimated from the bite on the catheter and from the amount of urine behind it, and the character of the infection, estimated by the pus secured. If pus is present, an effort should be made to sterilize the upper urinary tract by emptying it and washing it out with weak bichloride solution (from 1–100,000 to 1–10,000) every two or three days. For treatment see Stricture of the Ureter.

Tubercular Ureteritis.—One of the most frequent forms of ureteritis, which produces profound alterations in the coats of the ureter, is due to tubercular infection. This commonly involves the entire length of the ureter and is secondary to a tubercular kidney. The thickening of the ureteral coats converts the organ into a rigid tube, irregular on its outer surface, and presenting marked irregularities in its lumen.

The rare cases which present themselves for treatment, if of long standing, are one-sided.

The lining membrane of the ureter is ulcerated and the pelvis of the kidney filled with pus. When more advanced still, the bladder mucosa is affected, in degrees varying from some disseminated tubercles sowed about the ureteral orifice, all the way to an extensive diffuse infection with areas of ulceration.

Symptoms.—The chief clinical symptom is the frequent and painful urination, the patient being obliged to sit on the vessel every few minutes, and rarely being able to wait half an hour or longer.

Blood is only found in the urine in advanced cases, when it generally comes from the bladder. Pus secreted by the ureter is always present in varying quantities. Large amounts may be passed at intervals, being held back by the constriction of the lumen of the ureter, until sufficient pressure is developed in the upper ureter and renal pelvis to break through the obstruction. In this way we have intermittent pyuria, accompanied by a constant pyuria of lesser degree.

Fever is a symptom of cases in which the pus is held back in the kidney in quantity.

The diagnosis is, as a rule, not difficult to make when the various means of investigation at our command are employed. These consist in palpation by the vagina, rectum, and abdomen, in a cystoscopic examination of the ureteral orifice of the bladder, rarely in a direct inspection through an abdominal incision, in catheterization, with the isolation of urine from the infected area, and above all in the demonstration of the tubercle bacillus in the urine.

It is often necessary to make repeated examinations before the tubercle bacillus can be found. A source of error here is the smegma bacillus which is found around the genitals of both sexes and which has the same staining qualities and the same size and form as the tubercle bacillus.

Grünbaum (*Lancet*, January 9, 1897), who has studied the question experimentally, comes to the conclusion that, "as a rule, careful catheterization eliminates all sources of diagnostic error." These conclusions he drew from the examination of the urine from 47 persons—10 male and 37 female. The urine in all cases was centrifugalized and stained in the ordinary manner for the tubercle bacillus. He could not find the smegma bacillus in any of the ten specimens voided by the men, though its presence in the male urethra has several times been demonstrated.

Of the thirty-seven specimens from the women, eleven were obtained by the catheter, and in none of them was the smegma bacillus found, while, on the other hand, in twenty-nine voided specimens the smegma bacillus was found seventeen times.

Another method of deciding definitely whether tubercle bacilli are present is by the inoculation of the suspected urine into animals. I have operated on a case where the presence of a tubercular kidney was first diagnosed in this way by Dr. T. K. Holmes and Dr. A. McPhedran, of Canada. They made inoculations into the eye of a rabbit and also into the peritoneal cavity of a guinea pig, and in both places the tubercular lesions were readily demonstrated.

The method of inoculating the peritoneal cavity is easy, a few centimeters (2 or 3) of the suspected urine being injected into the unopened peritoneal cavity of the guinea pig with a clean hypodermic syringe. The animal dies, as a rule, in three or four weeks.

Strong presumption of a tubercular ureteritis exists if the vaginal examination reveals a ureter greatly enlarged, thick, hard, exquisitely sensitive, more or less nodular, lumpy, or uneven, and traceable by the rectum under anesthesia up to the pelvic brim. The characteristic tender spot will always be found at the brim upon palpating through the abdominal wall.

By cystoscopic inspection of the bladder we may infer the specific nature of the ureteral inflammation, either from the areas of extensive ulceration in the advanced cases, or from the scattered tubercles in the milder ones, located mostly at the base of the bladder and about the orifice of the affected ureter. An intense injection about the ureteral orifice may be the only vesical sign pointing to the affected side.

By catheterization of the ureter unmixed urine is obtained, which, in the earliest stages of the disease, may exhibit no changes at all; later, sparse tubercle bacilli may be found after repeated use of the centrifuge. When the tubercular disease is in an advanced stage, urine is obtained which is milky or thick with pus, peculiarly pale in color, and sometimes alkaline; it contains a markedly diminished amount of urea. The tubercle bacilli are found in the flocculent sediment, which begins to fall as soon as the urine stands for a short time. It may take five or six examinations to find the bacilli, but then they will often appear in great abundance.

The prognosis of the affection is years of invalidism, and life is finally destroyed when the kidney is full of pus, the ureter choked, and the bladder infiltrated and converted into a mass of ulcerations. Oftentimes, there is extensive tubercular disease of other organs as well.

The treatment is either palliative or radical, but the palliative course is only resorted to in order to improve the patient's condition for an operation if possible. Where the ureter is obstructed, and pus is dammed up above the stricture and in the kidney, a catheter may be passed, the pus drawn off, and the dilated portion washed out with a bichloride solution, beginning with 1 to 20,000. This may be repeated every few days until the general condition is so improved that the disease may be safely extirpated with the knife. Nephro-ureterectomy, or extirpation of the infected kidney and ureter, is the only possible means of cure. I have done this in three instances, and will describe the proper method of operating by giving the details of one case, which I owe to the courtesy of Dr. M. D. Mann, of Buffalo.

C. R. (No. 1836), aged thirty-one, began to suffer at the age of fifteen with an "irritable bladder" at the menstrual periods, the difficulty extending into the intermenstrual period as well after six months. Pain in the bladder soon became constant, and to this was added in another year pain in the left loin and down the thigh. In about five years the patient was pretty constantly confined to her room. No treatment produced more than temporary relief from the agonizing pain and spasms accompanying the act of micturition every few minutes by day and night, when her screaming could be heard at a long distance.

Upon examination, the left ureter was found thick, hard, and nodular, as if slightly constricted at irregular intervals, and in the left fornix something was felt like a distinct mass in the broad ligament. The slightest pressure on it produced exquisite pain and a desire to urinate. On catheterizing both ureters at the same time, several cubic centimeters of amber-colored urine collected from the right side, while none at all escaped on the left; but on pushing the catheter farther in, behind the broad ligament, there was a sudden escape of pale lemon-colored urine flowing in a steady stream until the beaker was filled (see Fig. 285). The urine on the right side was acid, while that on the left was alkaline, and also contained abundant pus and tubercle bacilli.

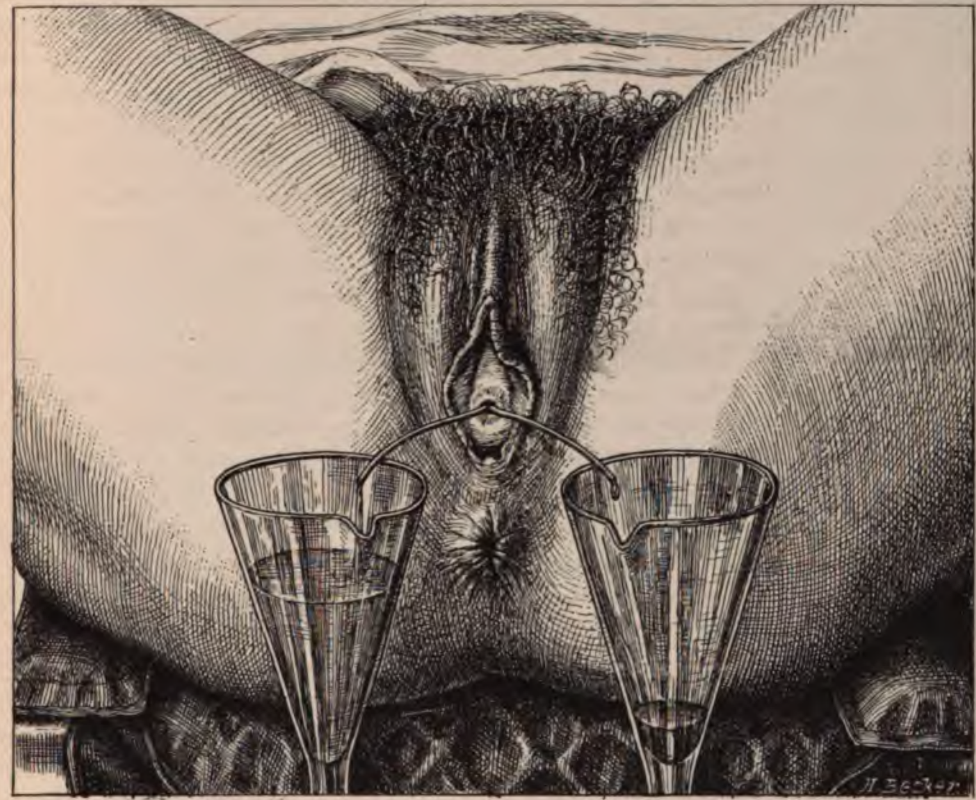


FIG. 285.—DEMONSTRATION OF STRICTURE OF THE URETER AND OF HYDROURETER.

Both ureters are catheterized; the catheters are crossed in the urethra so that the beaker on the patient's right side collects the urine from the left side. In the same time that the small quantity of dark acid urine collected in one glass, the pale lemon-colored alkaline urine poured out and almost filled the other glass. The catheters in this case entered as far as the brim of the pelvis only.

On trying to withdraw the left catheter, it was found firmly held in the bite of the strictured ureter. The presence of the stricture was further demonstrated by passing into the ureter a small bulbous bougie, which entered the enlarged portion and came out over the stricture with a decided jump. The rate of discharge from the left side further demonstrated the existence of a large pyoureter, for 150 c.c. (5 ounces) escaped in three minutes; at this rate of secretion the amount passed per diem would have been 72 liters, or about 18 gallons—a *reductio ad absurdum.*

Nephro-ureterectomy, or extirpation of the tubercular left kidney together with its ureter, was performed March 30, 1893. After due cleansing, an incision 16 cm. (6½ inches) long was made just outside of and parallel to the linea semilunaris, terminating below over the brim of the pelvis. The peritoneum was then opened, the small intestines displaced to the right, and the sigmoid flexure lifted up at the pelvic brim and carried to the right side, making tense its peritoneal fold, the outer layer of the meso-sigmoid. This was incised and the greatly thickened ureter exposed, where it crossed the common iliac artery. The incision through the posterior peritoneum was now carried on upward, freeing the descending colon up to the middle of the abdomen and laying bare the entire ureter, easily traced from its pelvic end up the kidney. The kidney was found in its normal position, covered with peritoneum and fat cellular tissue.

The peritoneum was next incised over the kidney and the process of enucleation begun. The separation was effected with difficulty, owing to the dense, adherent fibrous tissue, which interpenetrated the fat and stuck tight to the kidney, especially about the hilum. Slowly, and with much care, the large vessels were freed, and tied with four fine silk ligatures, after which the kidney was severed from all its attachments, except the ureter. Now, the kidney being held in the hand, it was pulled downward, and the ureter gradually dissected out of its bed of cellular tissue all the way to the pelvic floor. The ovarian vessels were tied in the abdomen at about the middle of the ureter.

The ureter was then ligated at the pelvic floor, and cut off wedge-shaped 1 cm. above the ligature, forming flaps for easy closure. Care was taken throughout not to contaminate the peritoneum with the infected end, which was finally burned out with a Paquelin cautery down to the ligature, and the flaps united with fine silk sutures. The left flank was then pushed out by two fingers and pierced with a knife, making a hole 3 cm. (1¼ inches) long in the line of the iliac crest, just in advance of the spinous muscles. A gauze drain reaching the ureteral stump below was put in here, 14 cm. (5½ inches) long by 3 cm. (1¼ inches) wide, and the anterior incision was closed. The colon fell into its natural position without suture.

On the first day there was a free bloody serous discharge, which gradually decreased, and the drain was taken out on the fifth day. The patient made a quick, undisturbed recovery, and is still living, thirteen years later, remarkably improved; her only difficulty is frequent urination, an hour and a half being the longest interval. For the removal of the entire ureter with the kidney by an extra-peritoneal operation, see Nephro-ureterectomy, page 518.

The following is the pathological report:

Kidney Macroscopically.—The mass representing the kidney is made up of four large lobules, separated from one another by shallow sulci. The upper third of the organ is least affected, though this is deeply pitted in every direction, and contains a number of small cysts, which become distended on injecting the pelvis of the kidney, proving direct connection. This portion measures 6 by 4.5 cm. (2½ by 1¾ inches), while the whole kidney mass measures 11 by 6 by 3.5 cm. (4½ by 2½ by 1½ inches). Below the mass just described on the anterior face is a cyst measuring 5.5 by 5 cm. (2⅕ by 2 inches), and below this two yellowish masses, 7 by 4.5 cm. (3 by 1¾ inches), independent of one another but connected by a shallow sulcus. All the cysts are covered by the capsule. The weight of the whole organ with the attached ureter is 100 grams.

The capsule of the kidney is thickened and intimately adherent in places. On section, about 65 c.c. (2 ounces) of fluid escape from the cysts; in one it is white and flaky, consisting almost entirely of fatty *débris*; in another, the fluid resembles blood-stained urine. These cysts are all found to communicate with the pelvis of the kidney and represent dilated calices. The parenchyma of the kidney is largely destroyed. In one place an area of cortex is found 7 mm. in depth, but elsewhere the kidney substance is represented by layers averaging 1.3 mm. in thickness spread out over the dilated calices.

Frozen sections of the kidney show a diffuse infiltration with fatty granulation tissue, and here and there areas of complete necrosis, with fragmentation of nuclei. Numerous definite tubercle nodules, containing giant and epithelioid cells, can be made out. The tubercular process goes gradually over into the more healthy kidney substance, and here and there a single tubule or glomerulus can be seen in the diffuse tubercular tissue.

Ureter.—The ureter presents two points of constriction, distant 3 and 8 cm. (1¼ and 3¼ inches), respectively, from the kidney. The hilum of the kidney is filled with dense adherent fat, preventing dissection of the stricture without tearing it.

The ureter is much dilated, more at some points than at others, the caliber of its lumen varying from 1.7 to 3 cm. (½ to 1¼ inches). Its wall is much thickened, measuring in places from 5 to 6 mm. The mucous membrane is of an opaque buff color, and at one spot, near the pelvis, there is a superficial *area of calcification* 5 mm. in diameter.

Frozen sections of the ureter show that the epithelium is entirely absent from the surface, and that the mucous membrane is converted into a mass of diffuse tubercular tissue, in which, here and there, definite tubercular nodules can be made out. The surface is not infrequently quite necrotic, and the cells near it have undergone fatty degeneration. The muscular layer has been involved, and there are many aggregations of small round and epithelioid cells there. In some places there is cell proliferation in the fibrous layer of the ureter. The connective tissue is from three to four times thicker than normal.

This ureter had been catheterized previous to the operation, and numbers of tubercle bacilli demonstrated in the pus which was present in the urine thus obtained. Cultures made from the pelvis of the kidney and from the kidney substance on ordinary agar-agar remained sterile.

Diagnosis.—Tuberculosis of kidney, pelvis of kidney, and ureter.

Although in the case just cited a transperitoneal route was followed, the best routine way to reach the ureter is entirely extraperitoneal (see *Johns Hopkins Hosp. Bul.,* Feb. and March, 1896), by means of a long incision begun back in the loin in front of the quadratus muscle, halfway between ribs and ilium, and continued in an oblique direction downward and forward, skirting the anterior superior spine within 4 cm. (1½ inches) of it, and ending in the semilunar line over the top of the broad ligament. The skin, fat, muscles, and fascia are divided down to the peritoneum, which is then dissected up by the fingers, being lifted toward the opposite side; the ureter is found, after raising the colon, crossing the belly of the psoas muscle with the ovarian vessels, and if not seen at once, it may be traced from the pelvis of the kidney down. It may further be recognized by tapping it sharply, or by watching a peristaltic wave pass downward. The peritoneum need not be opened at any point. After freeing the kidney by ligating its vessels and detaching the abdominal portion of the ureter as described, the pelvic portion is then freed by following the upper portion as a guide, while the fingers readily lift the pelvic peritoneum from the vessels which drop with the ureter over the brim. By pulling it out the ureter may be freed not only down to the floor of the pelvis, but well forward. To complete the enucleation as far as the vesical attachment, the uterine artery and veins must be tied and divided.

Obstruction of the Ureter.—Obstruction of the ureter, diminishing or obliterating its lumen, will be more frequently diagnosed when the opportunities of examining the ureters, afforded by abdominal surgery and catheterization, are more generally embraced. The importance of recognizing the existence of a ureteral obstruction can not be overestimated, on account of its damaging effect upon the kidney by diminishing, or even suppressing its excretory power; the dangers of an obstruction are vastly greater when both ureters are involved.

The immediate effect of obstruction is to back up the urine above it in the pelvis and calices of the kidney, producing hydroureter and hydronephrosis, varying in their clinical demonstrations according as the obstruction is produced gradually or suddenly, is partial or complete. If the hydroureter and hydronephrosis become infected, we have then to deal with a pyoureter and pyelonephrosis above the obstruction.

Causes.—Ureteral obstruction may be produced in a variety of ways, and it is far more common in women than in men, being frequently associated with diseases of the uterus and ovaries. Its causes may be classified in general as—

First, causes acting from without and occluding the ureter by pressing upon it or overstretching it; such are—

1. Ovarian tumors.
2. Uterine tumors.
3. Cancerous infiltration of the broad ligaments.
4. Cancer of the cecum.
5. Retroperitoneal pelvic sarcoma.
6. Aneurism of the iliac artery.
7. Scar tissue in the broad ligament.
8. Periureteritis.
9. An omental adhesion to the pelvic brim.
10. Thickened bladder walls.
11. Sarcoma of the bladder.
12. Pedunculate tumor of the bladder.

Second, foreign bodies lodged in the ureteral canal, as:

1. Calculus.
2. Blood clot.
3. Echinococcus cyst.

Third, affections of the ureteral walls themselves, as:

1. Ureteritis bacilli coli communis.
2. Ureteritis gonorrhoica.
3. Ureteritis tuberculosa.
4. Valve formation in the ureteral wall.
5. Gumma in the wall.
6. Cancer of the ureter.
7. Psoro-spermial cysts.

Some of the twenty-two causes of obstruction just cited act unilaterally, while others are more apt to act on both ureters at once; it therefore becomes important from a practical standpoint to divide them further into groups according to this tendency.

Both ureters are apt to be obstructed by cancer of the cervix uteri extending out into the broad ligaments, by thickened bladder walls, by some large subperitoneal fibroid tumors, and, in rare instances, by calculi.

One ureter only is apt to be involved in parametritis, small pelvic tumors and inflammatory masses posterior to the broad ligament, gonorrheal stricture, and tuberculosis.

The location of the obstruction, in almost all cases, is in the pelvic portion of the ureter, at some point between the brim of the pelvis and the vesical end. The reasons for this predilection lie, on the one hand, in the proximity to the ureters of the uterus, tubes, and ovaries, and their liability to inflammatory affections or new growths, and, on the other hand, to the fact that the ureters are enclosed with these organs in the unyielding, bony pelvic canal, which affords a point of resistance against which pressure can be made. Next in frequency to the pelvic extremity the upper end near the pelvis of the kidney is involved.

The clinical symptoms of obstruction are variable, depending on the cause and the completeness of the occlusion, as well as the rapidity with which it is produced. In the milder grades, where the distention is not great, there may be no symptoms at all. I have a patient whose right ureter and renal pelvis are dilated by a stricture at the vesical end of the ureter until they hold 100 c.c. of urine without producing any subjective sensations whatever. Extreme dilatation may be produced without pain if the cause acts slowly. I had one case, a little girl about three years old, in whom the right ureter was lifted out of the pelvis and dilated to a diameter of 1½ cm. by a retroperitoneal sarcoma.

Where the obstruction depends upon inflammatory disease the chief symptom is frequent and painful urination; in cases of tumors and pelvic inflammatory masses the ureteral symptoms are often masked by the associated complaint. The sudden closure of one ureter, as by a ligature, produces violent pain in its course, extending into the kidney, associated with restlessness, a hot, dry skin, fever and diminished urine. If both ureters are obstructed, uremia develops soon after the pressure in the sac of urine formed is equal to that in the blood vessels, and further secretion is checked.

To make a diagnosis three questions must be answered:

First, Is the ureter obstructed at all?

Second, What is the nature of the obstruction?

Third, What is its degree?

A diagnosis from symptoms alone can be made only in that small percentage of cases in which the occlusion has taken place suddenly, as in the case of a calculus or clot descending from the kidney, lodging in the ureter, and blocking its flow, or when in an operation the ureter is tied and the persistent agonizing ureteral and renal colic definitely located in its course leaves no doubt as to the nature of the difficulty.

There are no reliable symptoms of a dilatation of an aseptic ureter that has developed slowly. A diagnosis of obstruction with dilatation may be made with assurance whenever uremic symptoms are noted in the course of a cancer of the cervix.

While diagnostic means have been heretofore indirect and unsatisfactory, enabling us only to infer the existence of obstruction, and that in a small percentage of cases, the means of direct exploration of the whole ureteral tract now at our command leave but little to be desired in the way of accuracy. These means are the inspection of the ureteral orifices and the catheterization and sounding of the ureters.

Before describing the actual use of these methods it will be important to consider in what class of cases it is desirable to try to ascertain whether there is or is not an obstruction. I should always make an examination for obstruction where there is persistent pain in the course of a ureter; where the patient is distressed by frequent urination, for which a sufficient cause does not exist in the bladder or urethra; where there is pus in the urine in cases of pelvic inflammatory diseases; and where pelvic tumors might be supposed to make pressure on a ureter.

In investigating an obstructed ureter we wish to determine—

1. Whether there are any abdominal or pelvic tumors or masses which could press upon a ureter.
2. Whether any form of ureteritis exists.
3. Whether the ureter is blocked by a stone or clot.
4. Whether two of these conditions do not act in combination.

The presence of an abdominal or pelvic tumor pressing on a ureter can be determined by a bimanual and rectal examination and by deep abdominal palpation under anesthesia. Sufficient cause for an obstruction exists when a band of scar tissue, following injury in childbirth, is felt in the parametrium, dragging the uterus to one side, when an inflammatory mass is felt fixed to the pelvic wall and floor, or when there is a uterine or ovarian tumor choking the pelvis, or some other tumor filling the lower abdomen.

Palpation of the ureter through the vaginal walls shows whether it is thickened or not, and so demonstrates the presence or absence of a ureteritis.

The blocking of the ureter by a stone or a clot can only be demonstrated by the passage of a sound or catheter, and this brings us to the method of demonstrating with absolute certainty the existence of an obstruction. In examining any given case the investigation must not cease when one cause sufficient to explain an obstruction is found; other associated causes must always be sought for, and their absence definitely proved, before the one cause found is finally accepted. For example, an inflammatory obstructive ureteritis may be found associated with a pelvic abscess of the same side.

By the direct examination the existence of an obstruction is proved when (1) a ureteral catheter or sound passes freely up the ureter until it is suddenly checked, or (2) when each time after passing a certain point in the ureter there is an immediate continuous flow of urine varying in amount from several up to a hundred or more cubic centimeters. Sufficient time must be allowed to lapse for more urine to accumulate before repeating the examination. The demonstration is still more complete in a case of this kind if the instrument is distinctly grasped in the bite of the stricture and resists withdrawal.

In sounding and catheterizing a ureter for obstruction, the metal catheter is only of use for the lower part of its course, from the vesical orifice to the posterior pelvic wall. With gentle tact the metal catheter may sometimes be coaxed through a tight stricture impassable to the yielding silk catheters. As a rule, it can not be pushed in more than from 4 to 6 cm. (1½ to 2½ inches) under inspection with the patient in the knee-chest position, and it is better, after introducing it, to turn her over to the dorsal position, or to put it in, in the first place, in the dorsal position, and after letting the air out of the bladder with a catheter, to guide the further progress of the ureteral catheter with a finger at first in the vagina and then in the rectum. It is needful to empty out the air, as the distended bladder splints the catheter and impedes its onward movement.

An ordinary solid sound has no advantage over a catheter, which does equally well as sound and catheter. The only sound I have ever used with advantage is one made like a catheter, but solid, and with a slight bulbous enlargement, 1 cm. back of the point, which trips in passing any narrow place in the lumen.

The short flexible ureteral catheter is only valuable in locating strictures in the lower ureter, but is easy to introduce and is safer in experienced hands. The long flexible catheters, 50 cm. (20 inches) in length, are used to locate strictures in the upper ureter, all the way up to the pelvis of the kidney. It is always important in searching for a stricture to pass the catheter up slowly, so that the flow of urine will make it evident as soon as the stricture is passed. If the catheter is pushed up rapidly, the end may be several centimeters or more beyond the stricture before the flow begins, and the stricture in this way estimated to be higher up than it really is. A good telltale is made by dipping the finger in water and touching it to the end of the catheter, which is then closed by a thin film of water until the urine begins to flow, forcing the air out and pushing the water off from the end of the catheter in the form of a little bubble, in this way announcing the coming of the urine some seconds in advance of its actual appearance. The escape of urine backed up behind an obstruction is different from the intermittent normal flow, drop by drop. The urine which has been held back often pours out of the catheter in a steady stream until it has almost all escaped, when it continues to drop steadily for a while longer, and so the sac is emptied. The fact that the urine has been backed up, and that it is not simply an abnormally rapid secretion, can be proved by a simple calculation. For example, if the normal secretion is about 1.5 liters per diem (3 pints), this makes about 1 c.c. per minute from both sides combined, or half a cubic centimeter from one side. If now I collect 90 c.c. in three minutes after putting one catheter in, that equals 30 c.c. in one minute, or sixty times the normal amount, 90 liters (180 pints) a day, which is manifestly impossible.

An important part of the investigation is to decide exactly where the stricture ends and the dilated portion of the ureter begins. This is done by withdrawing the catheter slowly during the escape of the urine, and noting the moment the flow is checked; the length of the catheter inside, of course, then measures the distance of the upper end of the stricture from the meatus. To determine the distance from the vesical end of the ureter, the distance of the external meatus to the ureteral orifice is measured with the searcher and deducted.

The treatment of ureteral obstruction depends upon the cause; in some cases it can be easily removed, in others it is irremediable. An obstruction should never be allowed to persist, if it can be removed without undue risk to life. The danger of surgical interference is greater where both ureters are involved, and is greatest of all, if infection of one or both sides is superadded. Where both sides are occluded by a cancer in the broad ligaments, the plan proposed of prolonging life by severing the ureters just under the kidneys, and turning the ends out to discharge the urine in the flanks is rarely applicable on account of the condition of the patient by the time the disease has advanced so far. In case uremia is threatened from occlusion of both ureteral orifices by thickened, inflamed bladder walls, it will be proper to save the kidneys and preserve life by opening each antero-lateral vaginal wall, isolating the ureters, and making a longitudinal incision in them 1 cm. long, so as to suture them to the vaginal wall (colpo-ureterostomy). In case of recovery of the bladder, the ureteral fistulæ could afterwards be closed.

Where the ureteral dilatation comes from the pressure of a pelvic tumor, it is treated by taking away the tumor and removing the pressure. Indeed, this is often done in removing pelvic tumors without the operator knowing all that he has accomplished. In all cases of pelvic tumors both ureters should be inspected before removing the growth, for dilatation in varying degrees (hydroureter) will be discovered with surprising frequency. If to the dilatation an infection has been added, this will need treatment later, either by washing out the pelvis of the kidney and the ureteral tract, or by opening the pelvis in the loin. I have twice seen pelvic abscess in the left side associated with pyoureter and pyelonephritis. In another case a densely adherent ovarian cyst on the left side blocked the ureter. The upper ureter and pelvis of the kidney were filled with pus, and the enlarged kidney contained multiple abscesses. I removed the tumor and the kidney, after which the woman regained complete health and was living three years later.

Ureteritis as a cause of obstruction is quite common. The ureteritis itself can not be directly treated unless it has formed a stricture and the ureter is dilated above it; the treatment is then directed to the dilatation of the stricture and the removal of the infection. Where it is due to stone, relief will be obtained only by uretero-lithotomy. I have seen two cases of colon bacillus infection producing ureteritis. In one of them I opened the pelvis of the kidney and took out a small stone fitting like a valve into the mouth of the ureter, after which the pus disappeared from the urine.

Tubercular ureteritis can only be treated successfully when it is unilateral, and then by the extirpation of the ureter and its kidney. The kidney is generally so extensively diseased in these cases that the question of sacrifice does not arise.

Stricture of the Ureter.—Under stricture of the ureter I desire to discuss the treatment of localized contractions or occlusion of the lumen, due to inflammatory thickening or valve formations. According as these strictures differ in their causes, character, and location, so do the plans of treatment vary.

Where the closure is effected by a thickening of the walls of the pelvic portion, much will be gained by passing through it successively catheters increasing in size, 2, 2½, 3, 3½, 4, 4½, 5 mm. in diameter and 28 cm. (13 inches) long. The stricture is not entirely relieved by this plan, but the quantity of urine held above it is markedly lessened and relief from pain is afforded. This is the best, the safest, and the easiest mode of direct treatment in all strictures located low down in the ureter and due to chronic inflammation, excepting in tubercular ureteritis; here, too, temporary relief will sometimes follow a moderate dilatation and evacuation of the accumulation, with a regular washing out of the tract above.

In a case of tubercular ureteritis, in which I found a tight stricture well back in the pelvis, and drew off from time to time 100 c.c. (over 3 ounces) of pale, lemon-colored, alkaline urine, the patient felt better after each evacuation, but made no permanent improvement, as it was impossible to keep the channel open for even a short time.

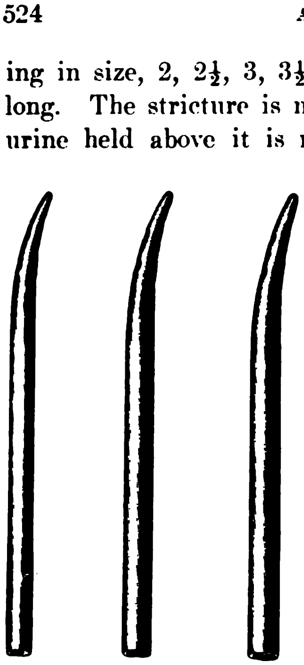


FIG. 286.—THE ENDS OF THE DILATING METAL CATHETERS, THREE SIZES (3, 3.5, AND 4), USED IN DILATING STRICTURE OF THE LOWER EXTREMITY OF THE URETER.

My method of treating a gonorrheal stricture of the vesical end of the ureter with pyoureter and pyelitis is demonstrated by the following case:

The patient came to me with an extensive accumulation of pus in the left ureter extending up into and filling the pelvis of the kidney, caused by a corkscrew stricture of the vesical end of the ureter. This was due to a gonorrheal infection.

I treated the stricture by dilatation with a series of ureteral catheters, increasing in diameter from 2 to 5 mm. After drawing off the purulent fluid, the ureter and pelvis of the kidney were washed out with medicated solutions. The caliber of the stricture was enlarged by the dilatations so as to reduce the quantity of the accumulation above it from 150 to 100 c.c. The purulent character of the secretion was removed and all trace of gonococci, at first abundant, disappeared.

My patient (E. S., San. 96) was a married woman, thirty-one years of age, of slight build and haggard-looking. She had had one child four years before without special difficulty, the only pregnancy in six years of married life. The menses were regular and without pain. Headaches were rare; the appetite was good and the bowels regular. She had no chills.

She had been feeling depressed for some months and had lost weight; she complained of severe pain on urinating, which persisted for a half hour or longer. There was a sense of pressure in the bladder, and she was obliged to urinate every two or three hours by day and oftener by night. There was no acute pain, but aching in the limbs and discomfort of the lower abdomen. She noticed that the appearance of the urine varied greatly, being clear at times, and at other times containing much yellow sediment.

My examination showed that the vaginal outlet was superficially torn back almost to the anus; the cervix was in the axis of the vagina, somewhat low down; it showed a slight tear, and the uterus was in retroflexion; the left ovary was displaced downward, not adherent, but tender on pressure. On examining the anterior wall of the vagina, no special tenderness was developed on palpating the bladder.

The ureters were then palpated by the vagina. The left ureter felt distinctly harder than normal and was somewhat thickened but without marked tenderness; it was also displaced toward the pelvic floor.

The bladder was then examined under atmospheric dilatation, with the patient in the knee-chest position, through the No. 10 speculum. There was evidence of a patchy, mild cystitis. The field opposite the ureter, the posterior pole, and its surrounding area were mottled, red, and injected, the vessels being obscured; the injection increased toward the vault, which was covered by fine granules over an area 4 by 5 cm., averaging one or two to the square millimeter, most marked on the right side. The tips of each of these granules reflected the light and gave the surface a bright, studded appearance. On the left side the surface presented in places a superficial worm-eaten appearance. On the right lateral wall, 2.5 cm. behind the ureteral orifice, was a ridge 2 mm. in height, extending downward to the base of the bladder. Near the right ureteral orifice was an area of intense congestion, presenting an edematous appearance, and surrounding the ureter, whose orifice could only be located by a little pallor in the form of a crescent. Posterior to the right ureter was a superficial ulcer 2 by 3 mm., with a narrow red border and a yellow center.

The left ureteral orifice was situated on a truncate cone, about 6 mm. in diameter at its base and 2 mm. at the top. It was slightly edematous, and on the urethral side broken up by a number of irregular papillary eminences. The site of the ureteral orifice at the first examination was marked by a yellow spot of pus. On introducing a searcher into the opening of the orifice, a thin stream of pus escaped and ran down on the bladder wall.

Upon leaving the ureteral catheter in the left ureter for three minutes, 11 c.c. of dark fluid escaped, followed by 6 c.c. of fluid containing much pus. In the twenty-four hours following the examination the patient passed 700 c.c. of urine.

During the whole time the patient was under treatment, from the 2d of March to the 2d of June, 1894, I catheterized her left ureter about one hundred and twenty times in all. The first three weeks of her stay were passed in repeated vain endeavors to get the ureteral catheter through the stricture into the ureter. Three difficulties prevented this at first. In the first place, the irregular papillary prominences on the left side, in the neighborhood of the ureteral orifice, obscured it, and made it impossible to locate it with precision subsequent to the first examination, in which pus was seen oozing out; in the second place, the location of the ureteral mons and its orifice were in extreme displacement to the left; in the third place, there was a spiral stricture of the intravesical portion of the ureter, and it was necessary for me to learn the twist of the stricture before I could pass the catheter at once at every sitting.

After almost daily efforts for three weeks the stricture was finally cleared by an accidental turn of the hand; this was more readily repeated on two or three occasions subsequently, but not without many discouraging failures, after which the ureteral orifice was definitely located on the side of the pyramid in relation to certain papillæ, and the direction of the stricture was ascertained, so that the catheter could be passed with ease. After pushing the catheter through the stricture with a half turn it entered about 8 cm.; a distinct sense of resistance was felt in attempting to withdraw it, due to the bite of the stricture, about 1.5 cm. long. So long as the point of the catheter went no farther than the stricture, no urine escaped; but as soon as the catheter cleared the stricture, pale urine began to pour out in a steady stream, continuing until 150 c.c. were collected in three minutes. Sometimes the first urine drawn off would be of a reddish-brown color, followed by a whitish sediment, and at the last a thick, creamy fluid like pure pus.

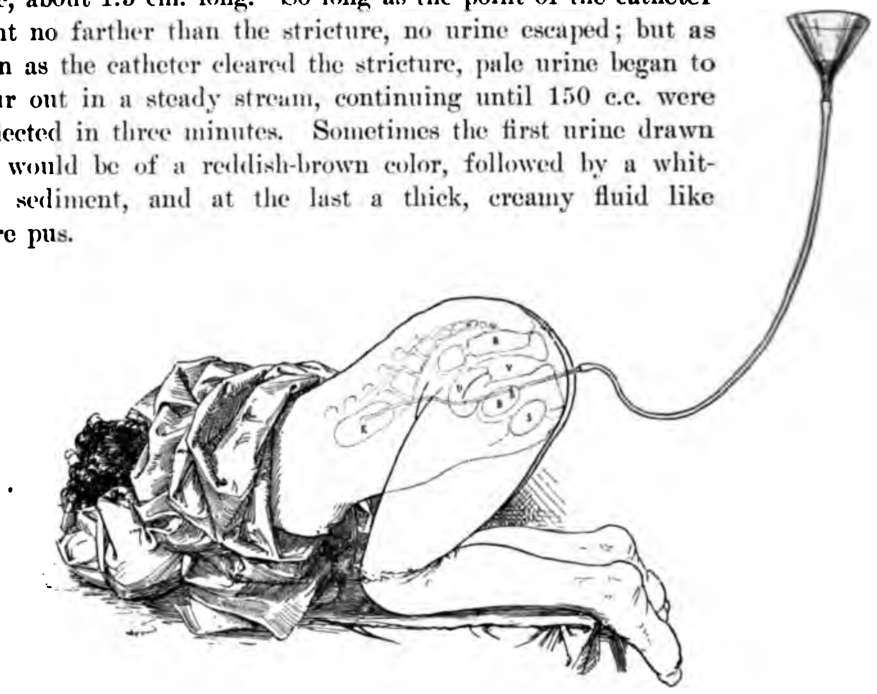


FIG. 287.—WASHING OUT THE RIGHT KIDNEY FOR GONORRHEAL URETERITIS AND PYELITIS.

A flexible catheter is usually used. In this case a metal catheter was passed through a stricture at the lower end of the ureter and the solution carried up to the kidney by gravity by means of a funnel and long rubber tube. The patient is in the knee-chest position to aid gravity.

The fact that so much urine escaped in so short a time proved conclusively that there was an extreme dilatation of the left urinary channels above the stricture, for, the normal rate of secretion being at the most 1 c.c. a minute for both ureters together, or 1.5 in three minutes for one ureter, the discharge of 150 c.c. would be one hundred times the normal amount, or at the rate of about eighteen gallons a day from one side alone; it was certain, therefore, that there was a dilated pyoureter and pyelitis.

After drawing off all the fluid, a piece of fine rubber tubing with a funnel at the end was connected with the catheter, and a saturated boric acid solution, equal to two-thirds of the quantity of fluid taken out, was run into the ureter by gravity simply by elevating the funnel filled with the fluid from 40 to 60 cm. above the level of the bladder. Care was taken to have the tubes full of fluid, so as not to inject air. The patient, during all these manipulations, was in the knee-chest position. She took no anesthetic, as the treatment was not painful. After the catheter was in the ureter she raised herself on her hands and knees to dispose the fluid to run out faster. When the injection was given she again let her chest down to the table, and rose again when it was to flow out. I found that I could wash the urinary tract repeatedly with the same fluid, if I desired it, by holding the funnel high for the fluid to run in, and by holding it an equal distance below the level of the table for it to run out again, often bringing with it a considerable amount of shreddy white *débris* from the ureter.

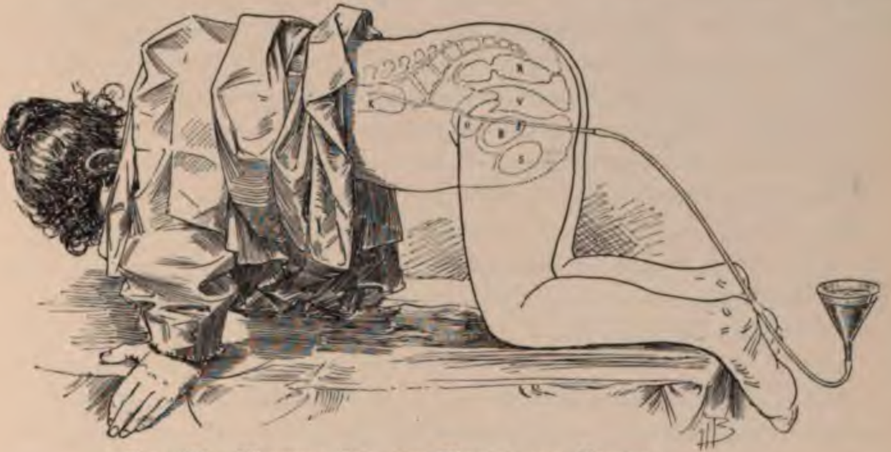


FIG. 288.—WASHING OUT THE KIDNEY AND URETER.

Letting the fluid run back again into the funnel from the kidney and ureter. The funnel is held low and the patient rises on the hands and knees to facilitate the outward flow. San., Mrs. S.

A small Y-shaped switch with a stopcock in the angle was used at times to facilitate the inflow and outflow of the solutions.

After the first few treatments the patient began to experience relief from pain and was less frequently disturbed at night.

Examination of the urine by Dr. Barker in the pathological laboratory of the Johns Hopkins Hospital showed that it was straw-colored, neutral in reaction, and contained abundant muco-purulent, stringy, tenacious sediment. There was a small amount of albumin, but no sugar, and no casts. The specific gravity was 1.032. There were many polymorpho-nuclear leucocytes, and many diplococci, nearly all of which were within the protoplasm of the leucocytes. Octahedra of calcium oxalate were found, and a few cylindroids. There were no tubercle bacilli, and no other bacteria than diplococci, which were of the typical appearance of gonococci, and much smaller than staphylococci or streptococci.

The bladder walls were treated by occasional applications of a 5 per cent solution of nitrate of silver, applied directly to the affected areas on absorbent cotton with an applicator; and by daily irrigations of a bichloride solution (1–150,000).

My first effort in the treatment of the case was to secure a continuous drainage of the ureter, and thus avoid all accumulation above the stricture, hoping by this plan to induce a contraction of the ureteral walls. To do this I made a short ureteral catheter 2 mm. in diameter and 5 cm. long, with a little shoulder about 2 cm. back of the inner end to keep it from slipping out of the ureter after introduction, and with a flange 6 mm. in diameter at the lower end, to keep it from slipping altogether into the ureter. I placed this in the ureter by means of a searcher used as a mandarin to conduct it through the stricture. I found, however, that its presence, after being in place for twelve hours, gave so much pain and increased the irritation of the bladder so much that I was obliged to abandon its further use, although mechanically it acted well.

My next plan, which was successful in curing the case, was to have ureteral catheters made in four sizes, increasing from the smallest, which was 2 mm., to the largest, which was 6 mm. in diameter. The points of the catheters were blunt and straighter than the ureteral catheters ordinarily used, on one side almost on a line with the shaft.

In the course of two months of such treatment the ureter was dilated sufficiently to permit the introduction of the largest catheter, from the end of which the accumulated urine would drop in a large free stream. With the catheters I began systematically to wash out the ureter and kidney with a bichloride of mercury solution (1–150,000), constantly increasing the strength until 1–16,000 was used. The treatment with the bichloride was interrupted several times for the injection of a 1 per cent nitrate of silver solution, and once for a weak iodine solution. Toward the end, while using the larger catheters, I was obliged some six times to suspend the treatment for from two to three days, on account of a chill followed by elevation of temperature from 102° to 104° F., with a quickened pulse (120), headache, nausea, and pain in the left inguinal region and legs. The patient was flushed and restless, and suffered from sleeplessness at these times.

The result of the bichloride washings was a complete disappearance of pus cells and gonococci from the urine, and a reduction of the size of the distended ureteral tract from one holding regularly from 140 to 150 c.c. down to one holding 90 or 100 c.c. The bladder assumed a normal appearance and the patient became able to sleep through the night without rising once. She gained 20 pounds in weight and resumed the rosy appearance of perfect health, with a corresponding remarkable improvement in spirits.

The treatments were discontinued August 8, 1894; I saw her again in January, 1895, and then, on two occasions, catheterized the ureter, drawing off only 90 and 100 c.c. of clear urine from the left ureter without a trace of pus or cocci. She had, therefore, recovered from the infection, but still had a stricture of the ureter of larger caliber, with a lax distended ureter above it.

I made several attempts to empty the ureter by massage, with considerable success at first, but the procedure became so painful that it had to be stopped. Just before the massage the bladder was emptied by catheter, and immediately after treatment as much as 90 c.c. of urine were secured.

I demonstrated the success of the massage and mapped out the exact positions in which to make pressure by placing the patient in the dorsal position and then introducing a catheter with a rubber tube attached to its outer end, when a straight glass tube, 50 cm. long, attached at the other end of the rubber tubing, filled at once with urine to the level of the ureter and acted as a manometer. Respiratory movements were traced by its rhythmical ascent and fall. On making pressure over the ureter through the abdominal wall the column ascended in the vertical glass, and, if the pressure was increased, it could be forced out over the top. If the pressure was made to one side of the ureter there was only a slight effect or none at all. By marking all the points of effective pressure on the skin, and afterwards connecting the markings, the course of the ureter was accurately mapped out.

The following important points are demonstrated by this case:

1. Stricture of the lower extremity of the ureter can be diagnosed without any operation, by using the cystoscope with the bladder dilated with air by posture.

2. Stricture of the ureter can be improved through gradual dilatation by a series of hollow bougies (catheters) and without a coloureterotomy. (See *Johns Hop. Gyn. Rep.*, No. 1.)

3. A stricture through which a No. 5 (5 mm. in diameter) bougie is passed every day for several weeks, will still hold back the urine, if the walls of the ureter above have lost their contractility.

4. Pyoureter and hydroureter can be diagnosed by drawing off in a few minutes such a quantity of fluid as it is manifestly impossible for the kidney to secrete in that amount of time.

5. Pyoureter and pyelitis can be improved, or even cured, by washing out the ureter and pelvis of the kidney, without any preliminary cutting operation to disclose the ureteral orifice (as in colpo-uretero-cystotomy, Bozeman).

6. Variations in pressure in the column of fluid in a distended ureter can be demonstrated by a manometer attached to the ureteral catheter.

7. In this way the course of the ureter can be mapped out.

There are several sorts of stricture in the upper part of the ureter at or near the junction with the pelvis of the kidney.

In one important group of cases the closure is intermittent, or depends on a ureteritis without a definitely localized stricture.

Complete closure may be congenital, or it may follow an injury or inflammatory disease. The treatment will depend upon the length of time which has elapsed since the occlusion was effected, as well as upon the result of the occlusion. Where the kidney has undergone atrophy nothing need be done. If it has become greatly distended, temporary relief may be afforded by tapping. If the occlusion is but recently acquired, the effort should be made by operation to make the passage pervious.

I have examined the first patient on whom I performed a nephro-ureterectomy, leaving 6 or 8 cm. of the lower end of the tubercular ureter, and found the position of the ureteral orifice in the bladder marked by a shallow pit impervious to the sound.

In another case of an intermittent hydronephrosis of long standing, due to a stricture of the ureter just below the pelvis of the kidney, in attempting to locate the stricture by means of a catheter the vesical opening was lacerated; a few days later the kidney was exposed and the ureteral stricture divided and sutured, so as to make a free opening from the kidney into the ureter. The pelvis of the kidney was drained through an incision in the dorsum so as to allow the repaired stricture to heal at rest. During this time the bruised lower end of the ureter, no longer kept open by the passage of the urine, closed completely, as I found by a cystoscopic examination several weeks later, when no efforts made to pass the sounds succeeded.

The following case of complete occlusion of the renal end of the ureter came under my care in May, 1894.

C. F. (San. 115, May 12, 1894), twenty-three years old, was suffering from an old fistula discharging pus beneath the left anterior superior spine. Her trouble began ten years before with "awful spells of pain" in the left side, extending around into the small of the back. These came about twice yearly and lasted two weeks at a time, when she had to stay abed on account of the pain and fever attending them. In the intervals she suffered from constant soreness in the left side. In 1890 she had a spell lasting a year, treated as "typhoid fever," and terminating in April, 1891, in an abscess in the left inguinal region, which was opened and 2 liters of pus and blood evacuated. The abscess continued discharging until October, 1892, when it closed. In June, 1893, she got worse again and the abscess reformed; it was opened in August, and after that the discharge was constant. Several gritty particles had escaped recently from the wound. Seven months before coming to me she had been in a sanatorium, where she was treated for spinal caries. Each time the sinus closed and pus accumulated she had a chill with pain and fever which lasted until it was reopened.

She was a little woman, under five feet in height, and well nourished. I found in the crease of the left groin, just under Poupart's ligament, the funnel-shaped orifice of a fistula, 1 by 2.5 cm. (⅖ by 1 inch), discharging a little thin, watery pus. The sound entered readily for 16 cm. (6½ inches) back toward the lumbar vertebræ. Her hip movements were normal. The back was tender, but showed no abnormality. There was an ill-defined but positive sense of resistance in the flank under the left ribs. The examination of a bit of gritty substance discharged from the fistula showed that it was made of amorphous urates.

A positive diagnosis was arrived at in the following way, by an examination under anesthesia. She was put in the knee-chest position and the No. 10 bladder speculum introduced. I was then able to pass a flexible renal catheter 26 cm. (10½ inches) on the right side. On the left side the catheter stopped suddenly, as if meeting an obstruction 23 cm. (9 inches) in, nor could it be induced to go farther. I then left the catheter in the left ureter over an hour, with its outer end lying in a receptacle. No urine at all escaped during this time. The diagnosis therefore was complete occlusion of the left ureter at the kidney, with abscess of the kidney discharging by a long fistulous tract at the anterior superior spine. The kidney was so completely disorganized that there was no chance of restoring its function, and the effort of the treatment was directed simply to doing away with the fistulous tract.

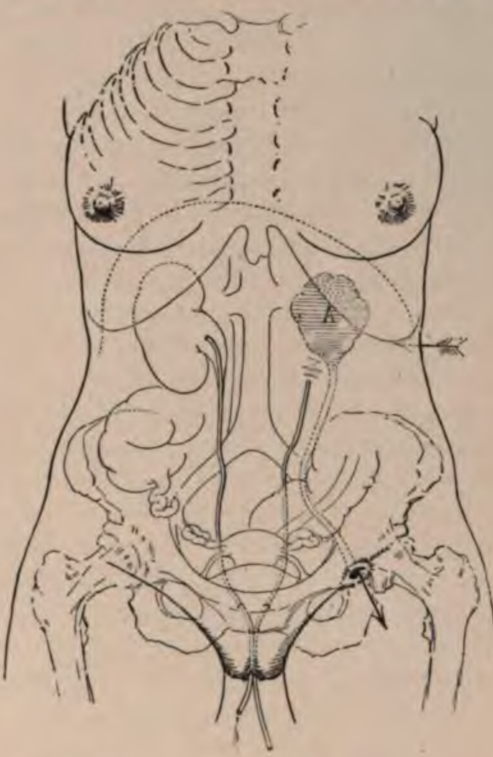


FIG. 289.—DIAGNOSIS OF OLD ABSCESS OF THE LEFT KIDNEY BY MEANS OF RENAL CATHETERS.

A, sinus discharging under the left anterior superior spine had been treated as a psoas abscess, but on inserting a renal catheter up to the right kidney and another up to the left, the catheter on the left side entered four centimeters short of that on the right side, and upon leaving both catheters in the ureter for an hour, that on the right side discharged urine freely, while none at all came through the left ureter. Upon cutting down on the left side in the direction of the arrow, an old cheesy focus was found occupying the situation of the kidney.

A cure was effected by making an incision 8 cm. (3¼ inches) long, between the crest of the ilium and the ribs, down through the muscles and a mass of inflammatory tissue, opening and evacuating several sacs of clear fluid, and scraping out one sac of cheesy material. Nothing was done to the ureter. A drain was left in and gradually withdrawn; she made a complete recovery and is well and married now, twelve years later.

Traumatic stricture is a rare occurrence, on account of the protected condition of the ureters. External injuries, involving a ureter, are almost invariably associated with such extensive damage to other important viscera that the patient does not often survive. In spite, however, of this comparative immunity, cases of traumatic stricture do now and then occur.

The accidents most liable to reach the ureter are stabs and gunshot wounds, a kick of a horse, a severe blow, or the crushing wound of a cart wheel. Manifestly men are far more exposed to such injuries than women. As Christian

Fenger has said, "Early diagnosis in these cases is often difficult, if not impossible, because of the uncertainty of the symptoms. A slight transient hematuria, which might easily be overlooked, was noted in three cases. Hematuria may be entirely absent. If no injuries to other organs complicate ureteral rupture, there are no grave symptoms in the beginning."

Swelling from the accumulation of urine around the place of rupture is often from one to seven weeks in developing.

In Fenger's analysis he shows that the treatment has never yet been directed at an early stage to the ureter itself, but has consisted in puncture of the sac when forming, or in incision and drainage. Most of these cases became septic, and a secondary nephrectomy was necessary to save life. In some cases where the collection was not opened the patients survived, with either an obliteration of the ureter or a stricture.

The treatment of strictures will vary according to their location. Those most amenable to treatment will be found located at the vesical and renal ends. I should propose to treat a stricture of the vesical end surgically by opening the vault of the bladder above the symphysis (*sectio alta*), exposing the orifice, so as to slit it back into the dilated portion, and then to unite the edges of the V-shaped cut with a fine continuous catgut suture, which will stop the bleeding and keep the urine out of the cellular tissue.

Fenger's plan ("Surgery of the Ureter," *Trans. Amer. Surg. Assoc.*, 1894) for treating a traumatic stricture of the ureter in its upper part, is by a linear longitudinal incision dividing the stricture. The ends and the sides of the incision are then sutured together so as to make a ureter of enlarged caliber. This plan was successfully carried out in the case of a man of forty-seven years, in whom the stricture was close to the junction with the renal pelvis; the patient had suffered for four years with intermittent pyelonephrosis. As the attacks increased in frequency a nephrotomy was performed, but no stone was found in the sacculated kidney. The ureteral entrance could not be discovered, either through the renal incision or after incising the pelvis. After making a longitudinal incision in the ureter below, the stricture was located in its upper part, and treated by making a longitudinal division and approximating the sides of the incision by sutures. Recovery took place in six weeks without a fistula.

Prof. E. Küster, of Marburg (*Arch. f. klin. Chir.*, Bd. xliv, chap. xxxvii, p. 850), had a case in a boy eleven years old, in whom he divided the ureter below a stricture at the renal junction, and transplanted the divided ureteral end into the pelvis of the kidney.

Two years before, the boy had had a left hydronephrosis, for which a lumbar incision was made, resulting in a fistula; from this time on, little or no urine came from the bladder, showing that the right kidney was either absent or inactive. In order to make the ureter patent, Küster made a lumbar incision and opened the pelvis of the kidney, exposing the ureteral orifice. On cutting this down to make it patulous, he discovered a stricture 2 cm. (¾ inch) below the kidney, necessitating cutting off the ureter transversely below the stricture. The lower end of the ureter was now enlarged by splitting it longitudinally, and then suturing it into the incision in the renal pelvis. The rest of the wound in the renal pelvis was closed with catgut.

The result was that four months later the patient was able to pass 100 c.c. (3⅓ ounces) of urine by the bladder in twenty-four hours, while the rest escaped by a fistula in the loin. This was closed by curetting and dilating the sinus and using buried sutures, when the recovery was complete, with a lumbar hernia.

Stricture is also formed by an abnormal entrance of the ureter at an acute angle into the renal pelvis, replacing the normal funnel-shaped opening. The orifice is situated high up in the side of the renal pelvis, and is valve-shaped, or minute and punctate. The nature of the obstruction is easily demonstrated by injecting fluid in both directions. It will be found to pass upward into the pelvis readily, but to escape from the pelvis into the ureter with difficulty. This condition of the ureter has been studied especially in its relation to hydronephrosis, which in some cases is caused by it, while in others it would seem that the twisting of the distended kidney produced the occlusion of the lower border of the ureter.

In the treatment of these cases two things must be done: First, the accumulation must be relieved, if it is distressing; and, second, the passage must be made patulous. The proposition to extirpate such a kidney should no longer be seriously considered, for even after a blockade of weeks or months the kidney retains to a remarkable degree its excretory power. In a case under my care I evacuated a hydronephrosis of six years' standing, withdrawing 155 c.c. of urine, in which I found 0.039 gram of urea to the cubic centimeter. This was done by placing the patient in the knee-chest position, and with the speculum and head mirror exposing the right ureteral orifice, when a delicate renal catheter was passed up into the ureter and the sac evacuated. If the stricture proves impassable, then the second procedure alone remains to be carried out—that is, the exposure and plastic repair of the contracted portion.

Fenger's plan of treatment of the valvular orifice is the best. He has carried it out successfully in the following way:

The patient was a woman, twenty-eight years old, who had intermittent hydronephrosis with severe pain. The lower third of the kidney was drawn forward into the wound in the left loin, the posterior surface of its pelvis exposed, and freed of the enveloping fat. An incision was then made, about 2 cm. (¾ inch) long, through the thickened pelvis. On holding this open with forceps, a small semicircular opening was seen at the lower portion of the inner wall, with its posterior border convex and the anterior border straight, forming a valve-like fold over the entrance which was likely to close the ureter when the pelvis became moderately distended.

This stricture was overcome by making an incision through the mucosa and the muscular wall of the renal pelvis and ureter without cutting through into the surrounding cellular tissue. The lower ends of the cut in the ureter and in the renal pelvis were now simply united by a single, very fine, silk suture, changing the vertical incision into a horizontal line and giving a wide exit into the ureter. In place of the No. 5 French bougie introduced at the outset, a No. 11 could now be passed. This was left in the ureter and brought out of a wound in the dorsum of the kidney to keep the ureter open while healing.

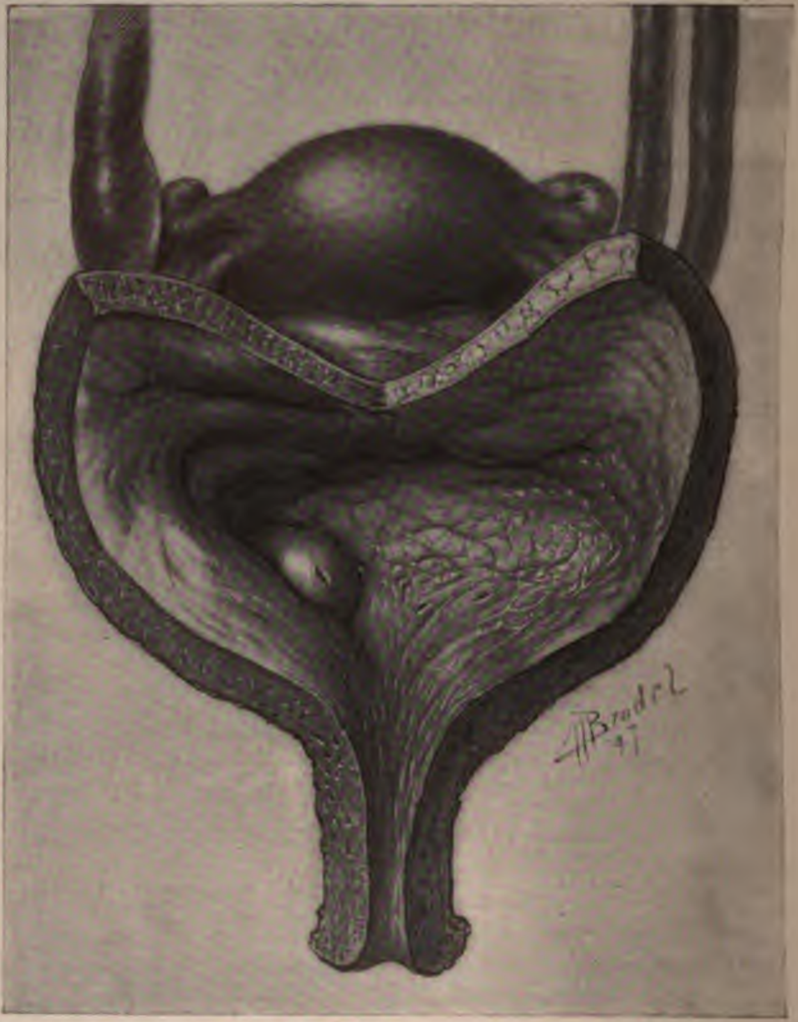


FIG. 290.—HYDROURETER OF BOTH SIDES, DUE TO STRICTURES PRODUCED BY A CANCER OF THE UTERUS; DOUBLE URETER ON THE LEFT SIDE FROM KIDNEY TO BLADDER.

Note the separate vesical orifices on the left, and the position of the right orifice on top of a cushioned eminence. ⅝ nat. size. JUNE 22, 1896.

The opening into the renal pelvis was closed by ten fine interrupted silk sutures, not piercing the mucosa. The wound was partially closed with extensive drainage. The bougie in the ureter was taken out on the second day. The woman recovered without a fistula, and had no return of the hydronephrosis.

Hydroureter, or an abnormal distention of the ureter with urine, is but the complement of stricture which we have just considered. The cause of the hydroureter and hydronephrosis, which is genetically the same and always associated with it, is invariably due to an obstruction to the outflow of the secretion, without infection. The various causes, therefore, are those just enumerated, which need not be cited again.

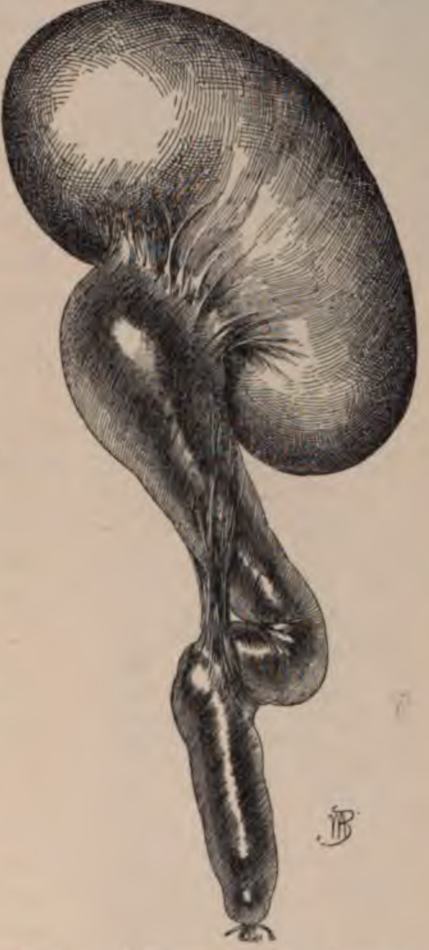


FIG. 291.—HYDROURETER AND HYDRONEPHROSIS, SHOWING KINK IN URETER DUE TO BAND OF ADHESIONS STRETCHING FROM THE LOWER PART OF THE PELVIS OF THE KIDNEY ALMOST DOWN TO THE PELVIC BRIM. ⅔ NATURAL SIZE.

Sarcoma of peritoneum. H. B. Autopsy APRIL 4, 1895.

Bilateral hydroureter and hydronephrosis may arise from an obstruction as low down as the urethra, or from a hypertrophy of the bladder walls. It has been noticed arising from the compression of the orifices in exstrophy of the bladder.

Pelvic tumors and inflammatory diseases act on one or both ureters according to their disposition. The hydroureter always extends from the point of constriction up into the pelvis of the kidney, which it involves (hydronephrosis). The tract included is therefore greater or less, according to the location of the obstruction. It is greatest when the stoppage is at the extreme lower end of the ureter, as in the case of a calculus plugging its orifice. One of the commonest forms, generally of lesser degree, is that produced by the pressure of large uterine or ovarian tumors, which is almost always greatest just at the pelvic brim, so that the hydroureter affects the abdominal portion only.

A marked case was found in one of my patients (S. A. H., 4039, Dec. 30, 1895), who died with an enormous carcinoma of the cecum filling the whole abdomen and pelvis. Following the distention, the ureter had become kinked, and adhesions had formed which bound the kinks together, so that the distention would have remained even if the cause had been removed.

In one instance figured in the text (Fig. 291) the ureter was obstructed by the pressure of a sarcomatous growth of the peritoneum; as the ureter distended it kinked, and became further obstructed by a band of adhesion uniting it to the pelvis of the kidney.

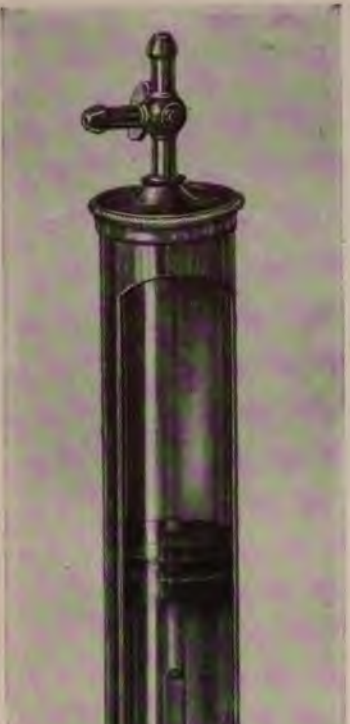


FIG. 292.—SYRINGE AND ASPIRATOR WITH COCK FOR INJECTING AND WASHING OUT THE PELVIS OF THE KIDNEY THROUGH THE RENAL CATHETER; OR TO INJECT FLUID SO AS TO DILUTE A COLLECTION OF PUS TOO THICK TO RUN OUT THROUGH THE CATHETER.

A sharp line of distinction between hydroureter and pyoureter can not be drawn; in many cases of hydroureter, pus is found in small quantities. In some instances the amount increases while under observation until it is so abundant that there can be no hesitation in calling it pyoureter; in other cases a pyoureter will rapidly improve and the pus diminish from day to day, ultimately leaving behind a simple hydroureter, while the observer is unable to decide just when the transformation took place.

Pyoureter.—Pyoureter is an accumulation of pus in the ureter. In order to bring this about, two things are necessary: First, an obstruction, and, second, an infection, or the infection may take place first and the obstruction develop afterwards. A common example of the first class is a hydroureter which becomes infected, while the second class is typified by the case cited under gonorrheal stricture of the ureter. Properly speaking, many of these cases should be classified under ureteritis and its sequelæ. The quantity of pus present varies from a large deposit, falling as a sediment in the urine as soon as it is withdrawn, or a thick and creamy pus only brought out of the catheter by suction, all the way down to a small quantity of pus just sufficient to give the urine a turbid or milky appearance, or the pus may even not appear at all until the urine is centrifugalized and put under the microscope. The same causes may act to produce pyoureter as hydroureter, of which the former may sometimes be considered an advanced stage.

Fever is, as a rule, only an occasional symptom. I have seen several cases where an intense intermittent colic was the most pronounced symptom, and where no calculus was present.

The diagnosis is made by the ureteral and renal catheters. Upon introducing the catheter and clearing the obstruction the pus or purulent urine will begin to flow. It must be borne in mind that urine thickened by pus will escape much more slowly than normal urine; if necessary, the discharge at the end of the catheter may be hastened by applying suction with an air-tight syringe.

Whenever the pus is inspissated or too thick to flow readily through the small catheter, it is best to dilute it by injecting some warm boric acid solution and allowing this to mix well with the pus before escaping again; by repeating this maneuver an accumulation may be evacuated in a few minutes which could not otherwise escape in the course of several hours. When the thick pus is in the pelvis of a large kidney the dilution may be aided, after injecting the solution, by manipulating the kidney freely between two hands.

I have met a number of cases due to tubercular ureteritis with stricture, and one case, already cited, of gonorrheal infection.

The prognosis depends upon the cause. In tubercular cases the disease is progressive until removed. In other cases the infection involves not only the ureter but the pelvis of the kidney, and also the kidney substance, impairing the secreting function.

The treatment will also depend on the cause, and the possibility of completely removing any obstruction to a free outflow. Disinfection of the whole urinary tract up into the kidney may be carried out as already detailed.

Ureteral Calculus.—A calculus lodged somewhere in the course of the ureter is far more rarely found than one lodged in either the renal pelvis or in the bladder.

The chemical characters of such calculi are the same as those found in the kidney; the form, however, of a calculus which has lodged in the ureter for some time is peculiar, being elongate, from four to six or more times its diameter, which averages about 5 mm., and pointed at both ends (see Fig. 293). The forms of these calculi and the appearance of the layers show that they gain by accretion at the ends and lose by attrition at the side. A ureteral calculus has been observed 12.5 cm. (5 inches) long. Small calculi may be round or even horseshoe shaped, as in Dr. R. B. Hall's case (*New York Medical Record*, Oct. 18, 1890). The pelvis of the kidney is the source of these calculi, which drop down into the ureter or are slowly forced down, until they lodge somewhere in its course.

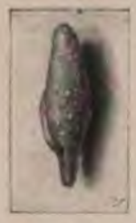


FIG. 293.—A URETERAL CALCULUS WHICH WAS PASSED SPONTANEOUSLY, SHOWING THE CHARACTERISTIC OVOID FORM. ACTUAL SIZE.

I had one case of a ureteral calculus forming upon a silk thread used to suture the opened ureter to the vaginal vault (colpo-ureterostomy) for the purpose of treating a stricture of the ureter. The patient suffered intense pain from vesical spasms until I discovered the stone and took it away. It was about 6 mm. in diameter.

Ureteral calculi lodge by preference within certain well-defined limits—for example, just below the renal pelvis, about the flexure at the pelvic brim, and the pelvic floor, are decidedly points of predilection.

The symptoms produced by a stone lodged in the ureter are, attacks of severe pain extending from the kidney down the course of the ureter, and sometimes accompanied by rigors. The pulse is elevated and there is fever.

The point of location of the stone is tender on deep pressure. These attacks are intermittent, and recur at variable intervals as long as the stone remains. With the attacks may often be noticed the formation of a tumor in the loin of that side. Where the stone is not lodged, but is gradually descending toward the bladder, its advance can be traced by the patient, and is often marked by bloody urine. Mechanically, the obstruction produces a hydroureter and hydronephrosis, varying in grade according to the completeness of the obstruction; if there is infection, pyoureter and pyonephrosis may arise. In time the function of the kidney becomes greatly impaired, but it is remarkable how persistently it continues to excrete a diminished percentage of urea after months and years of such interference.

The valve action of a stone in plugging the ureter and then permitting the dammed-up contents to escape suddenly, is well shown by the history of Dr. Hall's case, cited above, in which he found a renal tumor the size of a pint cup, which was not present the day before.

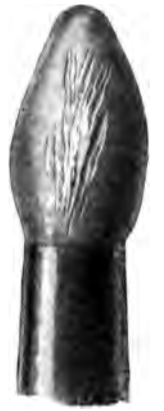


FIG. 294.—SCRATCHES MADE BY INTRODUCING WAX-TIPPED CATHETER A SHORT DISTANCE INTO THE URETER.

Its introduction was marked by the immediate escape of 8 c.c. of urine, showing obstruction, and on its withdrawal the scratches were seen. The ureteral orifice, rendered non-sensitive by the injection of a 1 per cent cocaine solution into the tissues through the vaginal wall, was then dilated with ureteral metal catheters, when the stone escaped. The entire manipulations were conducted through a vesical speculum.

A presumptive diagnosis will be made when all the symptoms above described are found. It must be remembered, however, that the passage of a blood clot, or the temporary closure of the ureter by an inflamed and thickened mucosa, may give rise to similar symptoms. The most certain of all means of diagnosis are direct examination by vagina, by rectum, by cystoscope, by catheterization of the ureter, or by an abdominal incision. A stone of good size lodged in the ureter in advance of the broad ligament can be felt through the anterolateral wall of the vagina and rolled under the finger. Back of this point the normal ureter is easily accessible *per rectum*, all the way up to the pelvic brim, by following the landmarks described, and the palpation is all the easier if the ureter contains a foreign body.

A cystoscopic examination may be so fortunate as to disclose a stone projecting partly into the bladder. By using the metal catheter with a diaphragm on the end a stone can be recognized all the way back to the posterior pelvic wall, or even up above the brim, by the click when it is struck. Above this point the diagnosis is based upon the fact that an obstruction exists in the form of a foreign body, which is demonstrable upon passing the flexible renal catheter, tipped with wax, which takes an impression from the stone.

When the calculus is lodged in the ureter, the wax-coated catheter invariably reveals its presence (see Figs. 294 and 295). If the wax coat is put upon the catheter at intervals as well as on the tip, or if the whole surface of the catheter is coated (Sampson), the distance of the calculus from the upper pole of the kidney and from the urethral and ureteral orifices can be easily measured, and its exact location determined. As the catheter is withdrawn there is often a tendency to disturb the position of the stone in the long axis of the ureter in such a manner as to wedge the catheter. By noting the bite of the stone, and then noting the precise point at which the catheter is released from the bite, the distance of the stone from the external urethral or from the ureteral orifice can also be measured.

Fig. 295 shows the gouge made in the wax-tipped catheter by a calculus first located in the kidney. On opening the kidney, however, no stone was found. I then, at the request of my colleague, the operator, examined the patient again, and upon making a retrograde catheterization, through the pelvis from above, I located the stone in the lower portion of the ureter, and removed it through the vagina.

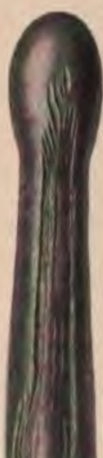


FIG. 295.

These scratch marks were made by passing the wax-tipped catheter down the ureter through the pelvis of the opened kidney in search of a lost stone. The stone was located in the lower end of the ureter, and removed by the vagina.

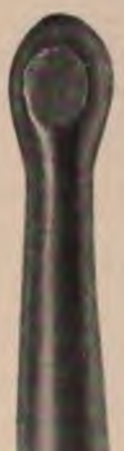


FIG. 296.—A WAX-TIPPED BOUGIE.

The facet is produced by the contact of the wax with the side of the speculum, and could not be mistaken for a scratch mark.

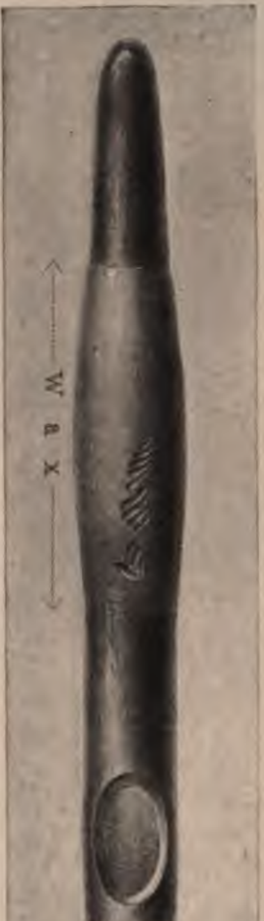


FIG. 297.—END OF A WAX-TIPPED CATHETER.

Diagnosis of renal calculus by means of a wax coat on the catheter. The scratch marks were made by the calculus shown in Fig. 298. Four times enlarged.

There are three sources of error which must be borne in mind in order that they may be avoided. In the first place, the contact of the wax with the side of the speculum may produce a facet like that shown in Fig.

296. This should never be mistaken for a scratch; and the wax need not touch the edge of the speculum if the catheter is introduced with a steady hand and the outer rim of the speculum utilized as a fulcrum. In the second place, the catheter should be introduced into the ureteral orifice with one direct forward movement; any to-and-fro movements near the vesical rim of the speculum are liable to produce scratches. In the third place, on withdrawing the catheter, the speculum having been already removed, the vulva must be held open, so that there is no contact with the genital hairs.

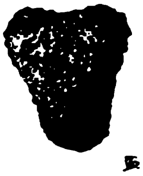


Fig. 298.—Calculus of the Pelvis of the Kidney found by the Wax-tipped Catheter introduced by the Ureter. Natural Size. Jan. 29, 1896.

Mrs. P. had a calculus in the pelvis of her right kidney, and a catheter coated with dental wax softened with olive oil was passed up into the kidney, the vesical speculum was removed, and the catheter then withdrawn. Upon placing the glistening wax surface under a lens, the scratch marks seen in Fig. 297 were plainly visible, and at the operation the calculus shown in Fig. 298 was removed.

Another patient, sent to me by Dr. F. Henrotin, of Chicago, had a calculus in the kidney which gave the following evidences of its presence: The renal catheter was passed into the pelvis of the kidney, and upon withdrawing it, its end was found hammered down and scratched, as seen in *b*, Fig. 299; in the eye of the catheter was lodged a bit of a stone (see *a*, Fig. 299), and upon magnifying this (*c*, Fig. 299), it was found smooth, black, and mammillated on one surface, and on the other jagged, crystalline, and buff-colored; showing that it had been broken off from a larger stone.

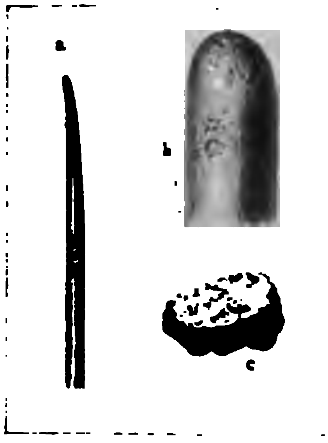


Fig. 299.—*a*, Stone caught in the Eye of a Renal Catheter. Actual Size. *b*, End of Catheter Hammered down and Scratched. Magnified. *c*, Free and Broken-off Surface of the Same Stone. Magnified. Aug., 1895.

The treatment is both palliative and radical. It is proper to use palliative treatment during the attacks, relieving the pain with hypodermics of morphin, and producing relaxation by hot baths and packs. Where a number of stones have passed previously, it is best to wait and see if the attack in question will not also pass off in the same way. When, however, the stone is caught and refuses to advance, if the symptoms are urgent and the formation of a renal tumor shows that the stoppage is complete, no time should be lost in resorting to surgical measures.

In the surgical treatment of ureteral calculus its removal is effected by an extraperitoneal or by a transperitoneal route. In the extraperitoneal method the peritoneum is not opened at all, but even when the stone is caught in a portion of the ureter lying beneath the peritoneum, the latter is loosened and turned to one side and the ureter arrived at in this way from behind. In the transperitoneal method the anterior abdominal wall is opened, preferably in the semilunar line, and the ureter exposed and incised, making in this way two incisions through the peritoneum on opposite sides of the abdomen.

The extraperitoneal route is always to be preferred, on account of the danger of peritonitis, and on account of the risk of a urinary fistula, which will be safer behind than across the peritoneum.

In two positions the stone must always be taken out by the extraperitoneal route: First, when lodged anywhere between the kidney and the superior strait; second, when lodged in the anterior part of the pelvis, under, or in front of the broad ligament. The ureter is more easily accessible from the brim of the pelvis down to the broad ligament after opening the abdomen, but even here it is better to make a long lateral incision and peel up the peritoneum, so as to get at the stone in this way.

The presence or absence of infection also influences the choice of route. When the urine is discharging pus from the affected side, the extraperitoneal route must always be followed, on account of the enormously increased risks of infection if the peritoneum is opened. As stated in discussing the diagnosis of stone in the ureter, it may be proper in doubtful cases to make a preliminary abdominal incision in the semilunar line in order to locate the stone, and then to remove it by a lateral incision.

The various operations for ureteral calculus are performed as follows: When the stone is found lodged in the lower, vaginal part of the ureter, if its end can be seen through the cystoscope projecting into the bladder, the effort should be made to grasp it with a pair of ordinary forceps, or alligator forceps, with a hook, or in a noose, and by traction, aided by pushing from behind with one finger in the vagina, to draw it out of its bed and through the urethra.

If this fails, and whenever the stone is behind the vesical orifice of the ureter, it must be reached by a vaginal incision.

After definitely locating by touch the part of the vagina nearest the stone, the patient is put on her back, or in the lateral posture, and the posterior vaginal wall retracted, exposing the anterior and the lateral walls.

The bladder is emptied, and a longitudinal incision is made through the vaginal wall about 3 cm. (1¼ inches) long; pulling apart the borders of the incision and dissecting down into the cellular tissue, the enlarged ureter is exposed and caught by passing blunt hooks under it, above and below the stone. A longitudinal incision is then made in the ureter over the end toward the bladder, just large enough to push the stone through endwise without any tearing. After this is accomplished a bougie is run up the ureter to make sure there are no more stones above, and the ureteral incision is sewed up with five or six fine interrupted catgut sutures, introduced with a delicate, curved intestinal needle, each one embracing the outer coats and avoiding the mucosa. If a good closure is secured and there is no infection, the vaginal wound may be closed too, but if there is much pus in the urine it is safer to drain the vaginal incision.

The remainder of the ureter can be exposed by the incision in a line beginning in front of the quadratus muscle, halfway between the crest of the ilium and the ribs, and extending obliquely downward and forward above the anterior superior spine to the semilunar line, where it ends over the pelvis. The incision, which must be a generous one, is carried boldly through the skin, and three layers of muscles down to the fat overlying the peritoneum. Most of the bleeding vessels are best clamped, but the arteries should be tied with fine catgut. As soon as the fat layer is reached, the knife is laid aside and the incision drawn widely open with retractors, while with the fingers alone the peritoneum and cellular tissue are easily lifted up and dissected back toward the spine. In this way the ascending or descending colon is drawn to one side, and the ureter is exposed in its course across the psoas muscle. If not readily found, it may be detected by finding the kidney first and then tracing it down from the pelvis.

The stone will be found most easily, if it is a small one, by grasping the ureter between the thumb and forefinger and passing it between them from above downward until the foreign body is felt. A longitudinal incision is then made over the end of the stone, it is taken out, and the opening is closed at once with fine catgut sutures, embracing all but the mucous coat. Where the pelvis of the kidney has been opened to extract renal calculi, and a doubt is felt as to whether or not there is a calculus in the ureter, this may be determined by passing a sound down the ureter toward the pelvis. If a stone of any size is found the instrument will be checked, and a little wax on the tip will demonstrate the nature of the obstruction. The diagnosis of stone in the upper ureter may also be made by passing the finger through the lumbar incision made for nephrotomy down along the course of the ureter. I have been able to palpate the ureter in this way all the way to the pelvic brim over the common iliac artery, without making a longer incision than is necessary to deal with the renal stone.

The transperitoneal plan of removing calculi is safe and proper when there is no infection, and the stone is fixed in the ureter at a point near the pelvic brim. In this position the ureter is easily found and exposed, and may be treated through an incision in the semilunar line with the pelvis well elevated. The stone is then removed by a longitudinal incision closed by catgut mattress sutures embracing peritoneum and muscular coats. If the suturing is accurate, and there is no stricture below to dam back the urine, there is no need of a drain, and the abdominal wound should be completely closed.

W. A. Lane, of Guy's Hospital, operated on a calculus impacted in the ureter for twenty years (*Lancet*, Nov. 8, 1890, p. 967).

The patient, who was twenty-three years old, began having violent abdominal pains when she was three years old; she had hematuria when eight years old. Attacks of violent pain were referred to the left side low down and were accompanied by great irritation in the urethra. After each attack abundant pus appeared in the urine.

At a first operation a lumbar incision was made and the kidney explored: a "kink" in the ureter was found and corrected, but the pain soon recurred.

On July 5, 1890, an abdominal incision was made in the left linea semilunaris and the ureter palpated about the pelvic brim, where a stone was felt and pushed up; a longitudinal incision was made in the side of the ureter, a small oval stone three-quarters of an inch long was removed, and the opening closed with a fine continuous silk suture. The wound healed without leakage and the patient recovered. The calculus was made up of alternating layers of uric acid and urates.

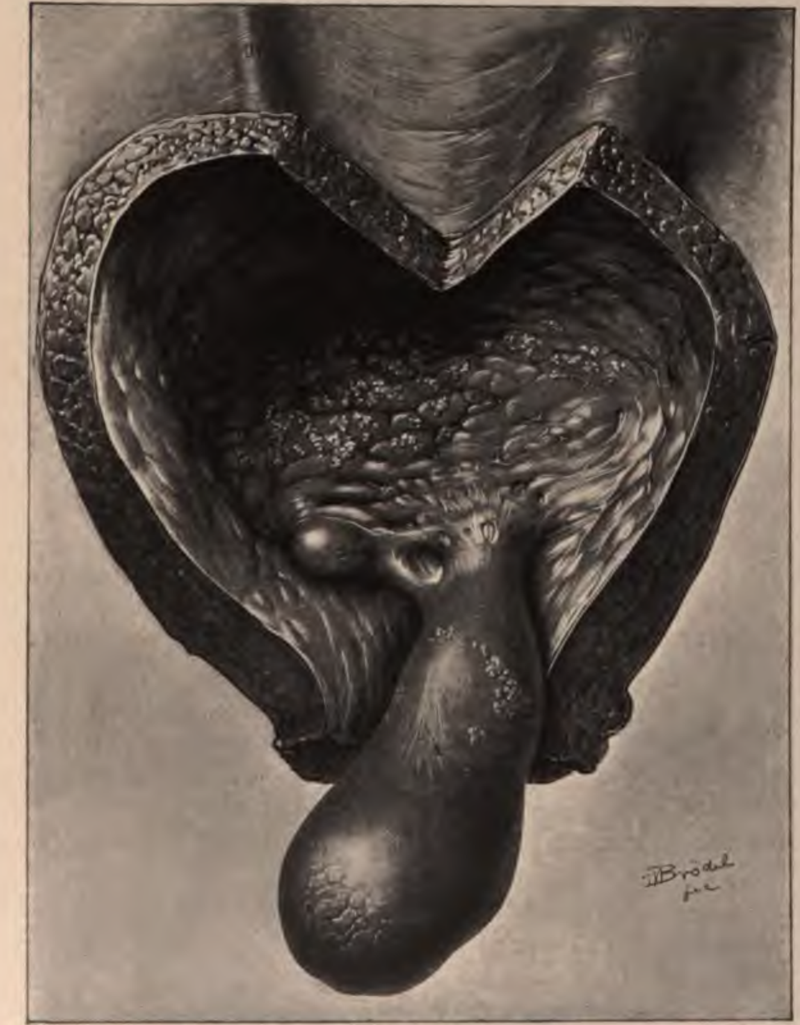


FIG. 300.—PROLAPSE OF THE URETERAL AND VESICAL MUCOUS MEMBRANE, MOST MARKED ON THE LEFT SIDE, SLIGHT ON THE RIGHT. DIPHTHERITIC INFLAMMATION OF THE BLADDER AND LEFT URETER. GREAT HYPERTROPHY OF THE BLADDER WALLS.

Note the position and narrowness of the ureteral orifices at *a* and *b*, and the large pyoureter above the bladder on the left and the smaller hydroureter on the right side. ⅔ natural size.

Prolapse.—An eversion or prolapse of the ureteral mucosa is one of the rarest of the ureteral affections. It is commonest in female children and oftenest congenital. The prolapse usually depends for its origin upon a narrowing or stricture at the ureteral orifice; the pressure of the urine filling the pelvis of the kidney and the ureter behind this, is then sufficient to cause the ureteral mucosa to pout out into the bladder in the form of a cystic tumor, with the obstructed ureteral orifice at some point of its periphery. In the child the prolapsed ureter may even escape through the urethra and appear at the vulva, where it may be mistaken for an everted urethra. An example of an acquired prolapse in a man, following an acute cystitis five years before death, is shown in Fig. 300, examined and reported by Dr. George Blumer (*Johns Hopkins Hospital Bulletin*, Sept.–Oct., 1896, p. 174). The patient died of an extensive urinary infection, to which this class of cases is peculiarly liable. The enormously hypertrophied bladder, in one place 3 cm. thick, was corrugated and covered with diphtheritic patches. On the right side there was a hydroureter and a cushiony protrusion into the bladder as big as the end of the thumb. On the left side, a pyramidal sac occupied the position of the ureteral orifice. The sac was fluctuating, 8 cm. long, 3 cm. in diameter at the base, and 9 cm. in diameter near its extremity. High up on one side the minute ureteral orifice was found (see Fig. 300) as big as a pin point and situated in the center of a small area of dense fibrous tissue. On opening the thin-walled sac, the finger could be carried directly up into the ureter.

Ureteral Fistula.—A ureteral fistula is an abnormal opening through which the urine is discharged directly from a ureter on to the surface of the body or into some part of the genital or alimentary tract, and in so far as the affected ureter is concerned the bladder is thrown out of use.

Ureteral fistulae are the result of trauma, or of ulceration, or they are congenital, and by far the commonest are those involving the anterior part of the pelvic portion of the ureter.

A uretero-vesical fistula is produced by a ureteral stone ulcerating through the ureteral walls into the bladder, or by the artificial making of a communication between the bladder and the ureter behind a strictured orifice. Such a fistula requires no treatment, but it should not be passed by without mention.

The commonest causes of ureteral fistulæ were formerly the traumatisms of labor, tearing open the uterus, vagina, bladder, and ureters, and leaving a permanent communication between the ureter and uterus, or ureter and vagina, forming a uretero-uterine or a uretero-vaginal fistula. Other causes acting but rarely were the ulceration through the vagina into the ureter, produced by a large pessary, or the cutting of a ureter on opening a pelvic abscess *per vaginam*. To-day the commonest cause of ureteral fistulæ is to be found in the frequently performed vaginal and abdominal hysterectomies in which the ureter is accidentally injured. In vaginal hysterectomy for cancer the wonder is that the ureter is not more frequently tied or cut, as it lies so close to the field of operation and is often so intimately involved in the disease. Indeed, it seems quite certain that this accident must occur with far greater frequency than is apparent from the reported cases. In rare cases both ureters are injured, forming a double ureteral fistula.

The diagnosis of ureteral fistula is not difficult. The traumatic forms must first be distinguished from the congenital. Congenital ureteral fistulæ almost always open at a point below the neck of the bladder, even as low down as the external genitals, while the traumatic forms open either at the base of the bladder, or, more commonly still, at the vault of the vagina, or into the uterus. An additional distinguishing feature is the fact that the congenital fistulæ are known to have existed from childhood, while the traumatic take their origin from some definite period in adult life.

The next step of importance is to distinguish ureteral from vesico-uterine and vesico-vaginal fistulæ. A fistula involving one ureter discharges constantly, while the patient is also emptying the bladder at regular intervals to discharge the urine received from the sound ureter. Care must also be taken to distinguish cases of small vesico-vaginal fistulæ situated high up, in which the bladder still retains some of its functional activity and discharges urine *per urethram*, in spite of more or less leakage.

By injecting the bladder with an aniline solution, or with sterilized milk, if the case is one of vesico-vaginal fistula, the colored fluid will escape by the vagina; if, on the other hand, the fistula is ureteral, the flow from the vagina will continue clear.

Berard's method of diagnosing between a ureteral and a vesical fistula is to empty the bladder and then cause the patient to sit on a vessel for two hours, when, if the fistula is a ureteral one, the amount of urine collected ought to approximate that drawn by a catheter at the end of this time.

Upon exposing the anterior vaginal wall and the vaginal vault the ureteral fistula is usually found near the cervix, imbedded in scar tissue. Upon introducing a flexible catheter or bougie into a ureteral fistula the instrument can be pushed up beyond the pelvis into the abdomen as far as the kidney, and if left in place the urine is seen dropping at intervals from the end of the catheter.

In every case of vesico-vaginal fistula, a careful search must be made to be sure that the ureteral orifice does not open on the margin of the fistula. F. Winckel has reported a case in which a minute fistula communicated with the bladder and the ureter at the same time.

A sure sign of a ureteral fistula is obtained by exposing the ureteral orifice and passing into it a sound or a catheter. If a fistula is present it will be found that the sound will only enter a short distance, not more than 3 or 4 cm., on the injured side, where it is stopped, and if the orifice is watched no urine will be seen to escape. On the sound side the metal catheter or sound can be carried back to the posterior pelvis and a flexible catheter can be pushed up to the kidney, while, if left in place, the urine is discharged through it.

Treatment.—Various plans have been devised for the purpose of diverting back into the bladder the urine which discharges through the fistula. The following is an outline of some of these methods:

1. By buttonholing the bladder and making an artificial vesico-vaginal fistula close to the ureteral fistula; then, after this has healed, bridging over a channel between the two fistulous orifices by drawing together the sound vaginal tissues at the sides.

2. By making an artificial vesico-vaginal fistula close to the ureteral fistula and then encircling both orifices in a ring of vaginal denudation, which is folded on itself so that the urine flows first from the ureter into a little vaginal pocket and then into the bladder by way of the vesico-vaginal fistula.

3. By dissecting out the end of the urethra and, after splitting it to prevent contraction of the orifice, turning the end into an opening made into the base of the bladder.

4. By making a big vesico-vaginal fistula in the vaginal vault near the ureteral fistula and closing the upper part of the vagina (partial colpocleisis).

5. When the ureter is not completely severed and the fistula simply involves its lateral wall, by closure of the fistula, by means of denudation and suture of its margins.

6. By opening the abdomen to release the end of the ureter and turning it into the bladder (abdominal uretero-cystostomy).

7. By total occlusion of the vagina after making a large vesico-vaginal fistula (total colpocleisis).

8. Removal of the kidney corresponding to the fistulous ureter (nephrectomy).

Of these various plans of treatment, no one is adapted to all cases, but that plan is to be selected which best meets the individual requirements of the particular case. In general the simplest plan should be followed as involving least risk to life and avoiding, if possible, any extensive mutilation, or the sacrifice of such an important organ as the kidney; the last thing to be thought of is colpocleisis or nephrectomy, and the abdomen must not be opened if a simple anastomosis can be effected *per vaginam.*

The condition of the patient must be carefully considered. I have had patients referred to me for the treatment of a ureteral fistula following vaginal hysterectomy, who were suffering from pelvic cellulitis and periureteritis, and so prostrated that I was unable to perform an operation. In one case the patient was emaciated, had a rapid pulse, and a constantly elevated temperature.

When the fistula is traumatic the best time to operate is some months after the receipt of the injury, because for several weeks after its appearance the mass of fresh young scar tissue forming in the vaginal vault is unfavorable for any kind of plastic operation.

Fistula in the Lateral Wall of the Ureter.—A fistula in the lateral wall of the ureter is easily closed by making a circular denudation in the vaginal wall around the opening, about 4 mm. in breadth, similar to the denudation for a vesico-vaginal fistula. The sides of the denudation are then brought together by means of a series of interrupted silk or fine catgut sutures, approximating the tissue in the direction of least resistance. I have had one operation of this sort to perform upon a patient upon whom I had previously opened the lateral wall of the ureter near the vaginal vault and sutured it to the vagina in order to get at and dilate a ureteral stricture in the back part of the pelvis. The denudation was made and the sutures were applied as just described, and the wound healed *per primam.*

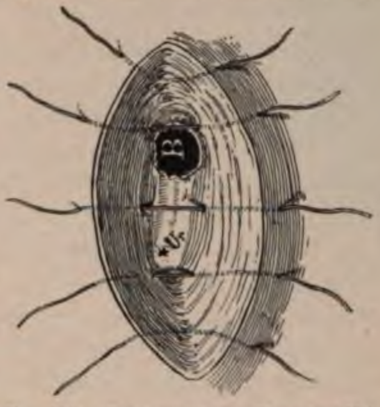


FIG. 301.—SWITCHING THE URETER (*Ur*) INTO THE BLADDER BY MEANS OF AN ARTIFICIAL VESICO-VAGINAL FISTULA (*B*).

The area of undenuded vaginal mucosa is seen between *Ur* and *B*. The five sutures bring the denuded vaginal mucosa together over this.

Ureteral Fistula at the Base of the Bladder.—A ureteral fistula situated at the base of the bladder is best treated by dissecting up the ureter to the extent of 1 or 2 cm., then perforating the base of the bladder, and turning the end of the ureter into it. The vaginal part of the incision is closed by interrupted sutures, taking care to catch the outer coats of the ureter in one or two of the upper sutures, so as to hold it fixed in the incision and thus prevent retraction, as described in the treatment of ectopic ureteral orifice.

Ureteral Fistula at the Vaginal Vault.—When the fistula lies in the vault of the vagina and there is enough loose vaginal tissue around it, the best plan of treatment is the formation of a vesico-vaginal fistula near by, not less than 1 cm. in diameter, then making a circular denudation, including both fistulæ, as shown in Figs. 301 and 302. The sides of the denudation on the vaginal surface are brought together by interrupted silk or catgut sutures. The difficulty in this operation is the tendency of the vesico-vaginal fistula to con-

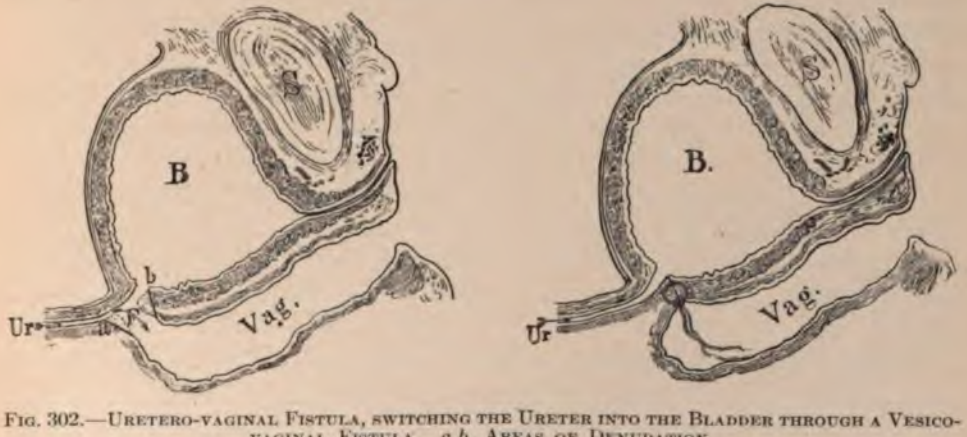


FIG. 302.—URETERO-VAGINAL FISTULA, SWITCHING THE URETER INTO THE BLADDER THROUGH A VESICO-VAGINAL FISTULA. *a b*, AREAS OF DENUDATION.

The union of the edges of the fistula is shown in the second picture. MARCH 8, 1896.

tract and close, and for this reason the opening must be made sufficiently large and the mucous surfaces of the vagina and bladder accurately approximated.

Uretero-cystostomy.—The abdomen should be opened, and the end of the ureter freed and turned into the bladder, in those cases where a sound kidney is discharging its urine into the vaginal vault, and where, at the same time, on account of the scar tissue or its retracted position, a vaginal operation establishing the connection between the ureter and the bladder is impossible.

Contra-indications to abdominal uretero-cystostomy are, an enfeebled condition of the patient, fresh scar tissue in the vaginal vault and pelvic floor, and an extensive periureteritis. I have twice been obliged to abandon the operation on account of periureteritis. This can be detected by first recognizing the mass of resistant tissue in the vaginal vault, and then passing a catheter up the ureter and examining by the rectum, when the ureter will be found, no longer free and movable, but imbedded in a mass of hard tissue extending a variable distance up toward the superior strait and distinguishable with difficulty.

Similar operations have been successfully performed by Drs. C. B. Penrose, of Philadelphia (*Univ. Mag.*, April, 1894), and Florian Krug, of New York. (See J. M. Baldy, *Amer. Gyn. and Obs. Jour.*, Nov., 1894, and H. J. Boldt, personal communication.)

It is important to note that the operations of uretero-ureteral anastomosis and uretero-cystostomy must not be looked upon as rivals in the same field. Where the ureter is cut far enough back from the bladder to permit an anastomosis of the upper into the lower end, the distance between the upper end and the bladder is too great to allow a uretero-cystostomy to be considered. Where, on the other hand, the ureter is cut near enough to the bladder to allow the upper end to be turned into the bladder, it will be found that the lower end is so short and so awkwardly placed that a uretero-ureteral anastomosis is not to be thought of.

There is but one class of cases in which the procedure is elective; that is, when the ureter has become lengthened and dilated by displacement upward over a uterine myoma. I would in this case elect to do a uretero-ureteral anastomosis if the ureter were dilated, or a uretero-cystostomy if it were of normal caliber.

The method of performing uretero-cystostomy is described in the following case, operated on seven weeks after vaginal hysterectomy: The patient (B. Z., J. H. H., No. 2990) entered the hospital in August, 1894, with an extensive carcinoma of the cervix, for which Dr. W. R. Russell, then the resident gynecologist, performed vaginal hysterectomy. The disease had extended so far out into the broad ligaments that he was obliged to place the ligatures at a greater distance from the cervix than usual. She recovered rapidly from the hysterectomy, but retained as a sequel a ureteral fistula in the vault of the vagina near the middle of the cicatrix. From this there was the usual constant leakage of urine, although she regularly passed the urine accumulating in the bladder from the other kidney. From a simple vaginal inspection it was impossible to say whether the flow from the cicatrix came from the right side or the left. It clearly did not come from the bladder, for it remained unchanged by the injection of a sterilized solution of milk into that viscus.

To decide which was the severed ureter I placed the patient in the knee-chest position and introduced my No. 10 cystoscope, when the bladder filled with air, and I was able to inspect the ureteral orifices. By introducing a searcher into the left ureteral orifice, I found that this ureter was intact as far as the posterior wall of the pelvis. Upon introducing the searcher into the right ureteral orifice it could not be carried in more than 2 cm., on account of meeting an impassable obstruction. The urine was seen flowing from the left ureteral orifice while nothing escaped from the right side. The demonstration was thus complete that it was the right ureter which was injured and the left was intact.

Having cleared up the diagnosis in this way, I proceeded to operate to relieve the condition, in October, 1894, seven weeks after the original operation.

Operation.—The patient was placed in the Trendelenburg position and an incision 12 cm. long made through abdominal walls loaded with fat. Every step throughout the operation was embarrassed by the obesity of the patient. After opening the abdomen, the large fat omentum and intestines were dislodged from the lower abdomen and pelvis with great difficulty, and held away by means of cotton gauze pads.

The end of the ureter could not be found on the pelvic floor on account of the rigidity and inflammation surrounding the line of scar tissue between the rectum and bladder. The right ovary and tube, which had been left, were also pinned down to this scar tissue by numerous vascular adhesions. The attempt to reach the ureter at this point was therefore abandoned and it was sought out at the pelvic brim, where it was readily found after lifting up the caput coli, incising the peritoneum, and pushing aside the fat. It was then traced from the point where it crosses the common iliac artery down to the pelvic floor, exposing the whole length of the pelvic portion by splitting the peritoneum over its upper surface. The anterior portion was involved in the inflammatory material surrounding the scar, which bled so freely that no attempt was made to dissect it out. Four centimeters of the lower end of the ureter lying directly behind the scar tissue were dissected loose and the ureter lifted up from its bed and divided close to the scar, sacrificing as little as possible of its length.

I now found that although I had cut the ureter to the best advantage possible under the circumstances, I could not do more than bring it into contact with the bladder by pulling on it. It was evident that if I were to suture it to the bladder I must exercise such a degree of traction that it would pull loose soon after the operation, leaving a uretero-abdominal instead of a uretero-vaginal fistula to deal with.

I was able to cope successfully with this formidable difficulty in the following manner: The bladder was dissected free from its attachments to the horizontal rami of the pubis on both sides, with scissors and fingers, and dropped down into the pelvis so as to extend it and carry it more into the back part of the pelvis, gaining at least 3 cm. in this way. By this means the ureter and the bladder were now easily approximated without strain. I then made a small incision through the bladder wall, which was covered with fat at least a centimeter thick, at the point on the right side nearest the ureteral end drawn straight across the pelvis. This incision passed through the peritoneum and was not more than 3 or 4 mm. in length, just large enough to receive the ureter snugly.

I then slit up the under surface of the ureter for about 4 mm., enlarging the caliber of its orifice to avoid a stricture, and with a pair of long delicate forceps introduced through the urethra, through the bladder, and through the incision, I caught the ureteral end, drew it into the bladder and held it there while it was being attached to the bladder wall by about six fine interrupted silk sutures passed through the muscular tissue of the bladder and the peritoneal and muscular coats of the ureter on all sides, beginning with the under side.

The ureter thus dissected out of its bed, and attached to the bladder, was stretched like a lax cord from the posterior part of the pelvis to the bladder, which lay gibbous and flattened out on the pelvic floor.

The abdominal incision was closed down to its lower angle, where a narrow gauze drain was inserted for fear of leakage. Care was taken in closing the incision not to draw together the peritoneum underlying its lower end, in order to avoid raising the bladder and indirectly pulling upon the ureter. No leakage occurred and the drain was removed, after which the wound healed without suppuration. The patient's urinary difficulties were immediately and completely relieved with the perfect restoration of continence.

At a subsequent cystoscopic examination I discovered the abnormally placed ureteral orifice opening into the posterior hemisphere of the bladder, into which it freely discharged its urine.

This case is one of especial interest for the following reasons:

I was able to determine on which side the injury had been sustained by sounding the ureter in the knee-chest position with the bladder distended by air. I was enabled, by a simple but delicate plastic procedure, to secure at once a perfect restoration of function without sacrificing any such important structure as a kidney. (See *J. H. H. Bull.*, February, 1895.)

The only case I know of in which a double ureter has been accidentally divided in the course of an operation, and then anastomosed into the bladder, was reported to me by Dr. Anna M. Fullerton.

"On March 10, 1897, the patient, R. L., thirty-six years old, the mother of six children, entered the Woman's Hospital, of Philadelphia, for a double pyosalpinx with ovarian abscesses. She had been ill and confined to bed for three months before admission to the hospital.

"At the operation the uterine appendages alone were removed; the uterus, not being especially enlarged, was allowed to remain, because the patient was not in fit condition for a prolonged operation. Dense adhesions existed; on the right side the adhesions were so firm that some of them required to be cut. Enucleation of the appendages was very difficult; a band passing across the pelvis a little below the brim was firmly adherent to the broad ligament a little below the uterine tube and at the junction of its middle and outer third. Not thinking of its being the ureter in that location, I severed it with scissors close to its attachment to the broad ligament. Upon doing this I found I had severed two canals covered with peritoneum and lying side by side imbedded in a common sheath of connective tissue. Each was the size of a normal ureter. No blood or fluid appeared to escape from the canals at any time. A sound was passed down through each canal to the bladder, and struck upon a catheter placed in the bladder. Similarly a long sound was passed upward through the superior pair of orifices, and passed several inches toward the kidney, proving the condition to be one of double ureter traversing the pelvis at a much higher point than normal, and thence passing between the folds of the broad ligament to the point of attachment to the bladder. The vesical ends of the ureters being ligated, the portion communicating with the kidneys was drawn down, and the two orifices introduced into the bladder by a common opening made in the superior portion of the organ a little to the right. The patient made a perfect convalescence, and was discharged, April 18th, in good health."

Extraperitoneal Uretero-cystostomy.—O. Witzel, of Bonn (*Centralb. f. Gyn.*, 1896, No. 11), has devised a plan for the anastomosis of the ureter into the bladder by bringing the ureter under the peritoneum in a new direction, so as to shorten its course. In addition to this, the bladder is detached and drawn out in the manner just described. The patient had a uretero-vaginal fistula which had been operated on in vain by the vagina. The abdomen was opened, the thickened ureter found at the pelvic brim and traced downward, after which it was divided at about the middle of the broad ligament. The lower end was closed by sutures and dropped, while the upper end was brought to the upper part of the incision at the brim of the pelvis, and drawn down beneath the peritoneum above the innominate line by a pair of long forceps started upward under the peritoneum to the right of the bladder.

The incisions in the pelvic peritoneum and the peritoneum in the median line of the abdomen were now closed, and the remainder of the operation conducted extraperitoneally.

The bladder was now pulled up on the right side until it reached more than 4 cm. ($1\frac{1}{2}$ inches) beyond the end of the ureter, where it was attached by some stout catgut sutures.

The ureter was then transplanted into the bladder by forming an oblique channel; the end of the ureter was cut off obliquely, and its mucous coat attached by fine catgut to the mucosa of the bladder, exposed through a small opening made over the end of a pair of forceps introduced through the urethra. Another row of catgut sutures outside of this attached the ureteral walls firmly to the vesical walls.

The oblique channel was then formed by uniting the bladder walls over the ureter on both sides. A drain was put in through a separate opening in the bladder, and the bladder was drained for four days.

The patient made a perfect recovery.

Nephrectomy, or removal of the kidney on the side corresponding to the fistulous ureter, must be performed when the kidney is extensively diseased and the seat of a suppurative, septic affection. An attempt should be made, however, to save the kidney by washing out the renal pelvis to cure any existing pyelitis, after the manner described in the treatment of pyelonephrosis.

G. Simon, of Heidelberg ("Chir. der Nieren," 1871), first extirpated the kidney for uretero-abdominal and uretero-vaginal fistulæ.

Schede (*Münch. med. Wochenschr.*, 1888, p. 512) extirpated the kidney in a case of uretero-uterine fistula after several plastic operations had failed.

Ureterostomy.—When the ureter is cut off in the course of an abdominal operation, and the upper end can not be grafted into the lower (uretero-ureterostomy), the only alternatives left are either to bring the ureter out onto the skin surface and to let it discharge there, or to extirpate the kidney of that side.

The plan usually adopted has been to bring the ureter out onto the surface of the abdomen in the incision in the median line. I have the report of such a case furnished by Dr. C. P. Noble, of Philadelphia.

The patient, thirty years old, had an extra-uterine pregnancy, requiring the removal of both tubes and ovaries together with the uterus. She had a pulse rate of 160, and when, toward the end of the operation, the right ureter was found cut off above the brim of the pelvis, she was so prostrated that the only thing to be done was to get through as soon as possible by closing the incision and sewing the ureter into it. The patient has recovered with a urinary fistula. Although ureteral catheters were kept in this ureter for more than six days, there was no infection, fever, or chill.

I am indebted to Dr. Noble also for a remarkable case in which he assisted at the operation.

The patient, a German woman fifty-eight years old, had a papillary tumor of the ovary, forming a large mass filling the pelvis and the lower abdomen. At the operation the abdomen was opened and 2,500 c.c. of fluid withdrawn from a cyst, whose wall was found densely adherent and continuous, with an extensive cancerous involvement of all the pelvic organs. The cyst was peeled out of the left broad ligament, tied off and removed. The left ureter was then found divided, but the patient was in such a bad condition that it was deemed inadvisable to prolong the operation, and the end of the ureter was brought out in the abdominal incision, which was closed. A flexible catheter was put into the ureter to conduct the urine away from the wound, but no urine ever flowed from that side, showing that the kidney was completely atrophied.

Ureterotomy.—Ureterotomy, or incision into the ureter (see *Johns Hopkins Hospital Bulletin*, Dec., 1894, p. 137), is practiced either for the removal of a foreign body from the ureter, or in order to pass a bougie into its lumen, with a view to ascertaining whether or not it is patulous.

The alternative of a ureterotomy is a cystotomy or incision opening the bladder and exposing the ureteral orifice, which can then be catheterized.

The method of performing ureterotomy is to expose the ureter by making an incision into the peritoneum 3 cm. long, preferably near the pelvic brim, where it is easiest to pick up and to handle the ureter, and then lifting it up a little out of its bed, to incise it longitudinally, cutting through its muscular coat and exposing and cutting the mucosa also, taking care not to injure its opposite wall. The delicate tortuous ureteral artery must also be carefully avoided. The incision should not be longer than 5 to 6 mm. It is closed with three or four interrupted sutures of fine silk passed with a delicate needle, including the muscular coats and leaving out the mucosa.

After neatly approximating the edges in this way, the ureter should be watched until two or three peristaltic waves of urine have passed down, to make sure that there is no leakage.

I have performed ureterotomy in one case to remove a foreign body (J. D. S., J. H. H., No. 4038, Dec. 27, 1895). It was an abdominal hysterectomy for cancer of the cervix, and hard-rubber bougies had been introduced into both ureters before the operation, in order to keep them perfectly distinct throughout. The result of the manipulation during the enucleation was that the right bougie broke off about 10 cm. (4 inches) behind its vesical orifice. I could not work the upper part of the bougie down into the bladder without injuring the mucosa with its sharp edge, so I lifted the ureter up, made the upper end prominent, and cut a hole in it just large enough to draw out the broken bougie. The little opening, 3 mm. long, was closed with two interrupted silk sutures penetrating the muscularis, and it healed without leaving a fistula.

I have also cut into the ureter four times, at a point varying from 3 to 4 cm. below the brim of the pelvis, for diagnostic purposes. The incision was made in each case with a view of determining whether the ureter was included in a ligature in the broad ligament.

In none of these cases had a bougie been placed in the ureter before the operation, so that the exact relation of the ureter to the cervix was a matter of doubt. After placing numerous ligatures close to the cervix to control oozing veins, the ureter was traced into close proximity to the ligated masses, in a case of hystero-myomectomy, one of hystero-salpingo-oöphorectomy for pelvic inflammatory disease with dense adhesions, and in two cases of panhysterectomy for carcinoma uteri.

In two cases after opening the ureter the bougie stopped short at the ligatured area, and the ureter had to be freed by cutting the ligatures. Although the ligatures were tightly tied, the ureter appeared to have suffered no harm from its brief constriction.

The little longitudinal incision in the ureter was closed with fine silk mattress sutures in two cases, and with interrupted sutures in the other two cases, each suture including the muscular coat. If mattress sutures are used, it is important to make the loop a narrow one, so as not to pucker the delicate ureter.

Uretero-ureterostomy.—Uretero-ureterostomy is the anastomosis of the upper end into the lower end of a divided ureter as a means of re-establishing its lumen.

The plan of implanting the upper end of a cut ureter into the side of the lower end was devised and successfully practiced on the dog by Weller Van Hook, of Chicago (*Jour. of the Amer. Med. Assoc.*, March 4, 1893), and utilized by me in the human being May 1, 1893 (*Annals of Surgery*, Jan., 1894, p. 70).

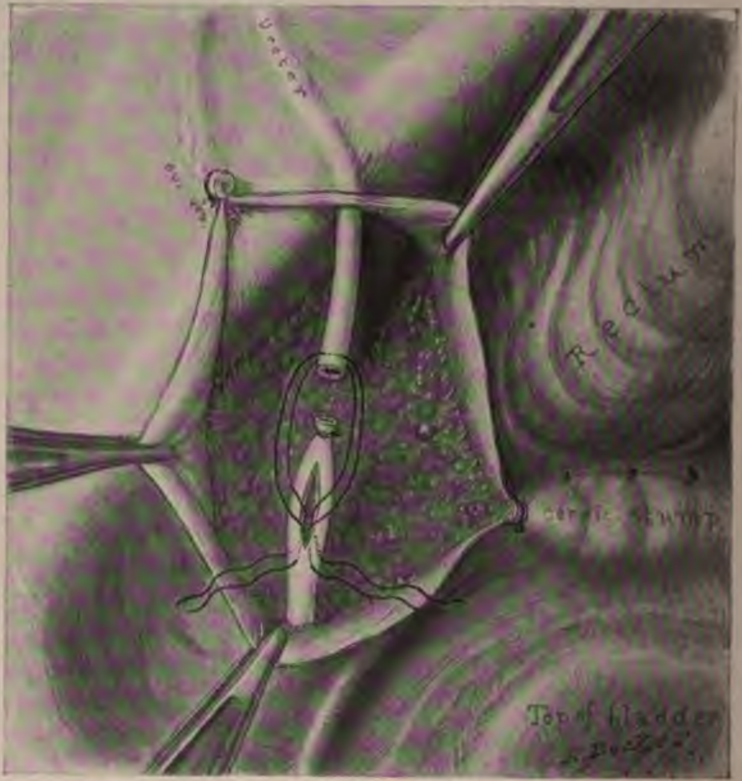


FIG. 303.—URETERO-URETERAL ANASTOMOSIS.

Showing the ureter divided and the lower end tied and split on one side, ready to receive the upper end which is drawn down into it by two traction ligatures. The operation was done on the right side after division of the ureter in a hystero-myomectomy. Recovery.

The patient was a negress (F. M., J. H. H., No. 1946), with a large myomatous uterus filling the lower two thirds of the abdomen, and lifting the right ureter high out of the pelvis.

The ureter, exposed for 7 cm. of its length on the anterior surface of an intraligamentary myoma 18 cm. (7 inches) in diameter, looked like a large, whitish, flat vein; it disappeared from sight at the cornu uteri among a number of other vessels. I took it for a vein, and doubly ligated and cut it in two, but a sound passed down into the bladder and another up to the kidney, after cutting the ligatures, at once demonstrated the error. After removing the uterus down to the vaginal cervix, and closing the cervical stump, I anastomosed the upper end of the ureter into the lower in the following manner:

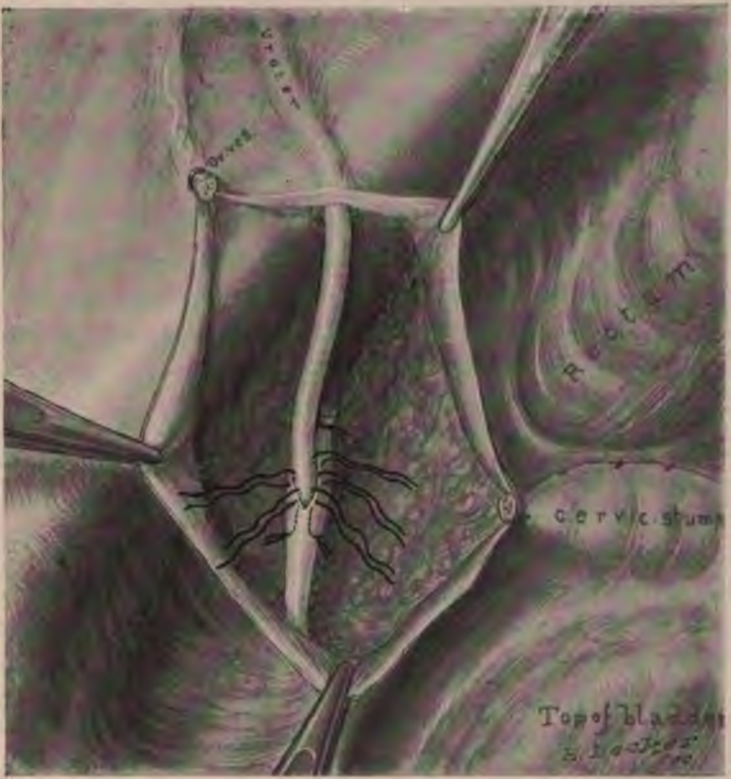


FIG. 304.—URETERO-URETERAL ANASTOMOSIS.

Showing the ureter held in place by the traction ligatures which have now been tied. The five untied sutures unite the entering ureter to the cut edges of the intussuscipient ureter.

The lower end was tied with a silk ligature close to its cut extremity, and then a slit about 1 cm. long was made lengthwise in the ureter just below this. The upper end was cut obliquely to avoid too great a contraction of its orifice, and was drawn down by means of a fine, silk, traction suture snugly into the slit, so as to project into the lower end, where it was held by fine silk interrupted sutures, each one of which grasped the edge of the cut and the wall of the intussuscepted end, as shown in Figs. 303 and 304.

The peritoneum should be drawn over the whole area of bared pelvic connective tissue, and the abdomen closed without a drain, such as was used in this first case. There was no leakage, and the patient recovered and was in good health over three years after the operation.

A sketch and a diagram are also shown of a similar operation performed upon the dog by Dr. J. C. Bloodgood at the Johns Hopkins Hospital. (See Fig. 305.) See also important papers by Bache Emmet, *Amer. Jour. of Obs.*, April, 1895, and J. W. Bovee, *Annals of Surgery*, January, 1897.

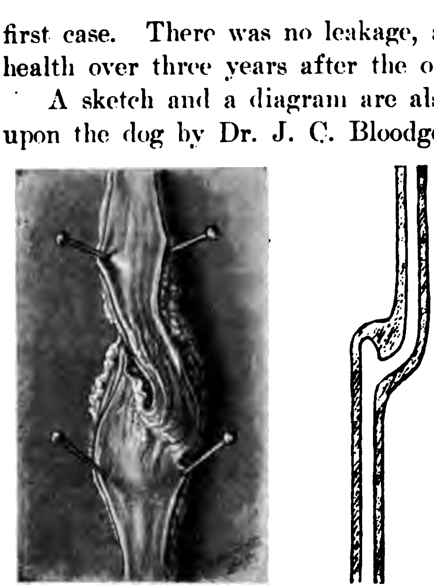


FIG. 305.—EXPERIMENTAL URETERO-URETERAL ANASTOMOSIS IN A DOG.

The ureter is laid open and its lumen exposed by four pins. The direction of the lumen and the little diverticulum above the anastomosis are shown in the right-hand figure. Actual size. Operation by Dr. J. C. Bloodgood.

Nephro-ureterectomy.—Nephro-ureterectomy, the extirpation of a kidney with its ureter, is indicated when there is a tuberculosis localized in one kidney and ureter, or when there is other extensive inflammatory disease of the kidney associated with such alterations in the ureteral coats as renders the recovery of the ureter after extirpation of the kidney improbable.

The kidney and ureter may be removed by one, or by two steps; by the first plan the kidney is separated from its connections, and the ureter is taken out immediately afterward; by the second plan the kidney is removed, and at some subsequent date its ureter, which has proved troublesome, is removed also (ureterectomy); such an operation as the last was performed on a man by Reynier, and reported at the Surgical Society of Paris (*Sem. méd.*, vol. i, No. 8, Feb. 24, 1893); his patient was twenty years old, and had a uretero-pyelonephritis, for which the right kidney was removed. He continued to suffer so much with the same side that five inches of the upper end of the ureter was removed by extending the lumbar incision, and, as he still did not improve, an unsuccessful effort was made to reach the pelvic end by a para-rectal incision. At a later date the last five inches of the ureter were removed through a suprapubic incision parallel to the inguinal canal, and the patient then made a complete recovery.

The better plan is to remove both kidney and ureter together. This operation is more formidable and more time-consuming than a nephrectomy, and for this reason the indications for its performance must be well established. By this I mean:

(a) The disease must be sufficiently advanced on one side to demand nephrectomy.

(b) The opposite side must either be sound, or so near sound as to be capable of supporting life by itself.

(c) The ureter of the diseased side must also be affected in the same manner as the kidney, either by a tubercular ureteritis or a pyoureteritis, or by a calculous ureteritis.

Unless much caution is exercised, the operator will often be tempted to proceed to this more formidable operation upon a false indication. For example, out of three cases which I have treated in this way (nephro-ureterectomy), all tubercular, the first had an extensive ureteritis, and the kidney was removed with its ureter down to the floor of the pelvis, but in the other two cases, although the kidneys were extensively diseased, although tubercle bacilli were demonstrated, and one ureter appeared thickened and tender to vaginal touch, with a marked mammillated, inflamed area about its vesical orifices, yet, in spite of all these indications, only a slight inflammatory thickening was found on removal, insufficient to justify this part of the operation.

It is clear from this that an irritation or a slight inflammatory thickening may be excited throughout the ureteral tract by a tubercular kidney, and that this will disappear of itself when the kidney is removed.

I would therefore make these distinctions: The ureter must not be removed with the kidney simply because it feels thickened and tender and its vesical orifice is inflamed; it must be removed when it forms a large, hard, somewhat gristly, irregularly nodular, exquisitely tender mass, which, as a rule, is strictured and dilated in different portions.

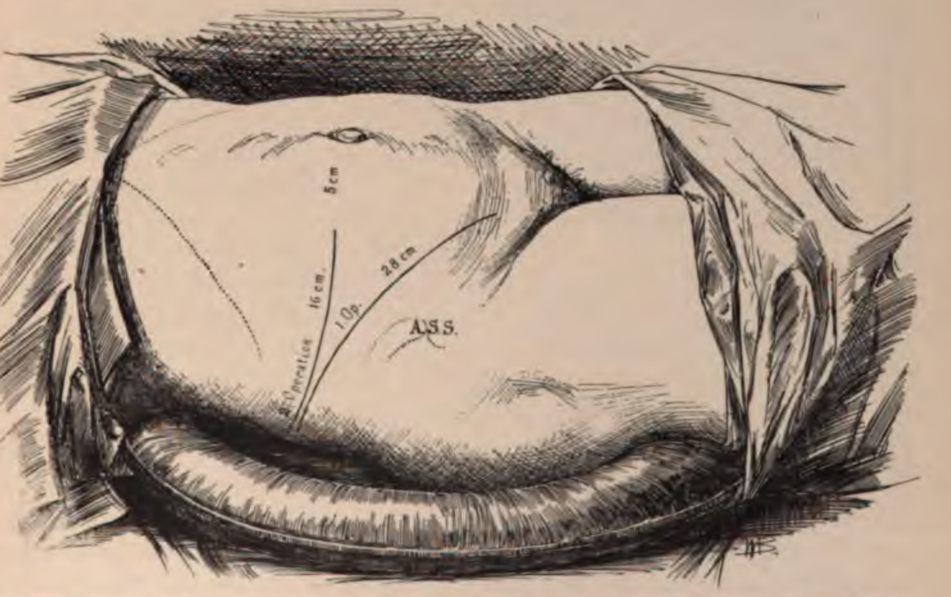


FIG. 306.—LINES OF INCISION MADE IN THE TWO CASES OF NEPHRO-URETERECTOMY, IN THE FIRST OPERATION 28 CM. LONG, AND IN THE SECOND OPERATION 16 CM. LONG.

My first case, removed transperitoneally, has already been described in the section on tubercular ureteritis. I have operated on two other cases, in each one removing the kidney, once the right and once the left, with a ureter all the way down to the vesical end. In the second case I lengthened the lumbar incision down to a point just above the pubic spine, and by detaching the peritoneum from the iliac fossa and the lateral pelvic wall, succeeded in taking out the right ureter, after doubly ligating and cutting the uterine vessels, without tying any other vessels or opening the peritoneum at any point (see Fig. 306).

Removal of the Right Kidney and Ureter through a Short Lumbar and a Vaginal Incision (see *Johns Hopkins Hospital Bulletin*, Feb., 1896, p. 34).—The plan of operation adopted in this case worked so well that I shall describe it fully.

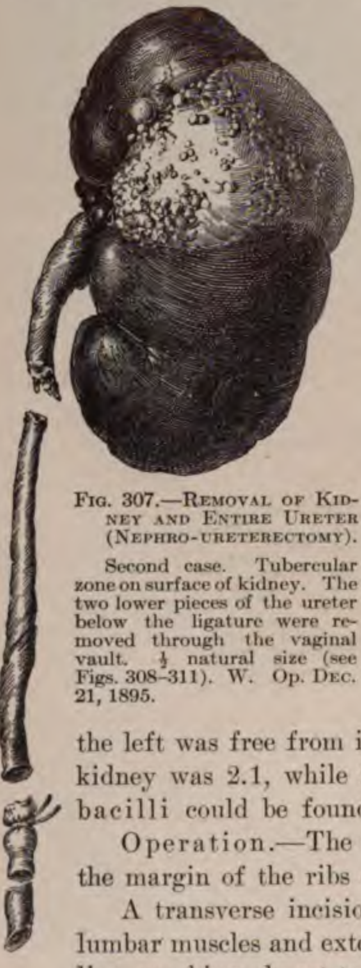


FIG. 307.—REMOVAL OF KIDNEY AND ENTIRE URETER (NEPHRO-URETERECTOMY).

Second case. Tubercular zone on surface of kidney. The two lower pieces of the ureter below the ligature were removed through the vaginal vault. ½ natural size (see Figs. 308–311). W. Op. DEC. 21, 1895.

The patient (K. W., J. H. H., No. 4012, Dec. 21, 1895) was a large, stout woman, weighing 225 pounds, and thirty years old. She had suffered for two years with attacks of violent pain, beginning in the region of the right kidney and extending around to the front of the abdomen and down into the pelvis. She also suffered from frequent, burning micturition. There was some pus in the urine, but she had never passed any blood or a stone. The attacks of pain, which at first were infrequent, finally came on as often as three or four times weekly, beginning under the right shoulder blade. They were so violent that she was wont to throw herself down on the floor screaming.

A urinary analysis, made after catheterizing both ureters, showed that the urine from the right side contained pus while that from the left was free from it, and that the percentage of urea from the right kidney was 2.1, while it was 2.6 from the left kidney. No tubercle bacilli could be found.

Operation.—The fat on the abdominal walls was 7 cm. thick, and the margin of the ribs close to the crest of the ilium.

A transverse incision was made, beginning in front of the quadrate lumbar muscles and extending 16 cm. across the abdomen in the umbilical line, reaching almost to the right linea semilunaris. Numerous bleeding vessels were clamped and tied with catgut. One large nerve, with vessels accompanying it, was divided between the transversalis and the peritoneum in the posterior part of the wound.

The perirenal fat was freed on all sides of the kidney, completely detached, and brought out of the incision. By drawing it down over the lower lip of the incision the renal vessels were exposed, with the pelvis of the kidney lying beneath them.

An examination was now made to determine, first, whether the kidney was diseased at all; second, whether a conservative operation could be done; and, third, whether extirpation was necessary.

The capsule of the kidney became almost completely detached in the simple manipulation necessary to bring it out of the incision. The upper and lower portions of the organ looked like a normal kidney substance intensely congested (see Fig. 307). At the middle there was a zone, 3 to 4 cm. wide, where the kidney was greatly thickened. This zone was of a pale color, slightly lobulated, and fluctuated on pressure, showing the presence of considerable fluid within. The peeling off of the capsule disclosed a markedly granular, white surface over an area about 2½ cm. in diameter on the anterior surface near the pelvis. A similar, irregular, depressed area with numerous white granules was also seen near the lower pole of the kidney, surrounded by tissue apparently healthy. The case was one of tubercular nephritis, limited to the right side, as shown by the previous examination of the urine separated from that of the opposite side. The broad affected zone extending entirely through the central portion of the kidney rendered any conservative resection impossible. The renal vessels were therefore clamped in three artery forceps 1 cm. from the kidney, after freeing them from the surrounding fat. Each of the vessels was tied with a silk ligature cut short. The vein, which was 8 mm. in diameter when flattened out, slipped from the grasp of its ligature as it sank back into the abdomen, but forceps at once checked a hemorrhage which would otherwise have been excessive. As it was, there was a free oozing from both ends of the mouth of the large vein, but it was fortunately found and caught by the forceps again deep down in the abundant fat under the ribs, and another ligature placed about it, by means of a needle and carrier, without drawing it up. Two other small, actively bleeding vessels were also tied in the perirenal fat.

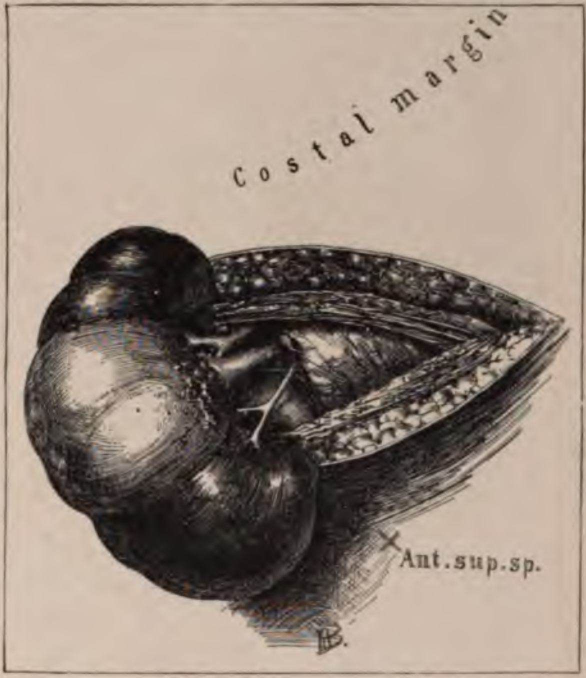


FIG. 308.—REMOVAL OF TUBERCULAR KIDNEY AND URETER.

The kidney is brought out of the horizontal incision in the right loin; the vessels are exposed and ready to tie. The ureter is seen behind the vessels. ⅔ natural size. First step.

The kidney and the entire ureter were now removed in the following manner: By pulling on the kidney and ureter, the latter was made tense and so easily followed and dissected out of its cellular bed, with the index and middle fingers pushing the peritoneum, the ascending colon, and the caput coli to one side, and stripping off the loose cellular tissue surrounding the ureter. This dissection was carried down to the brim of the pelvis, and the common iliac artery could be felt with the tips of the fingers over its entire length (see Fig. 309), with the thumb resting on the surface of the abdomen, the end of the thumb reaching the anterior superior spine.

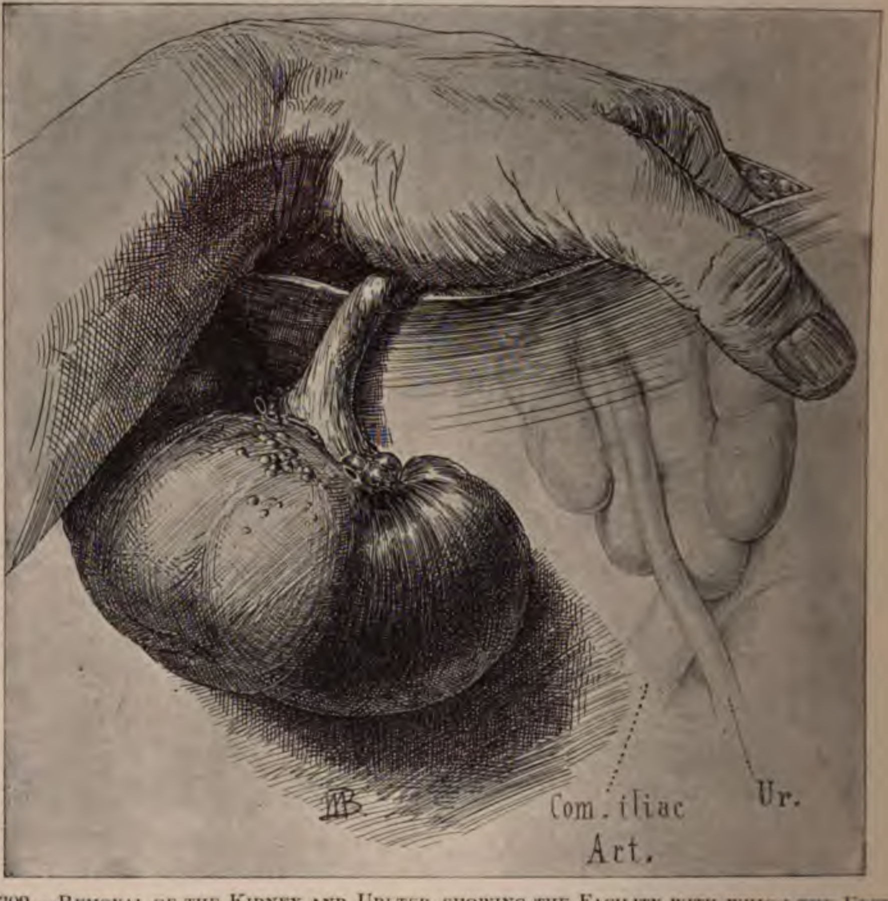


FIG. 309.—REMOVAL OF THE KIDNEY AND URETER, SHOWING THE FACILITY WITH WHICH THE URETER CAN BE PALPATED AND FREED ALL THE WAY DOWN TO THE COMMON ILIAC ARTERY WITHOUT INTRODUCING THE ENTIRE HAND INTO THE TRANSVERSE INCISION. SECOND STEP.

I now freed the ureter down to its vaginal portion by introducing the entire hand and part of the forearm into the cellular tissue, at first between the peritoneum and the abdominal wall, then under the peritoneum of the false pelvis, and finally between the peritoneum and the walls of the true pelvis. This blunt dissection with the fingers was facilitated by pulling on the kidney and making the ureter tense. In this way I freed it and followed it forward to the broad ligament. At this point considerable resistance was felt, and the ureter appeared to the touch to pass through a hole with a sharp border in its upper part. Above this I distinctly felt the uterine artery pulsating.

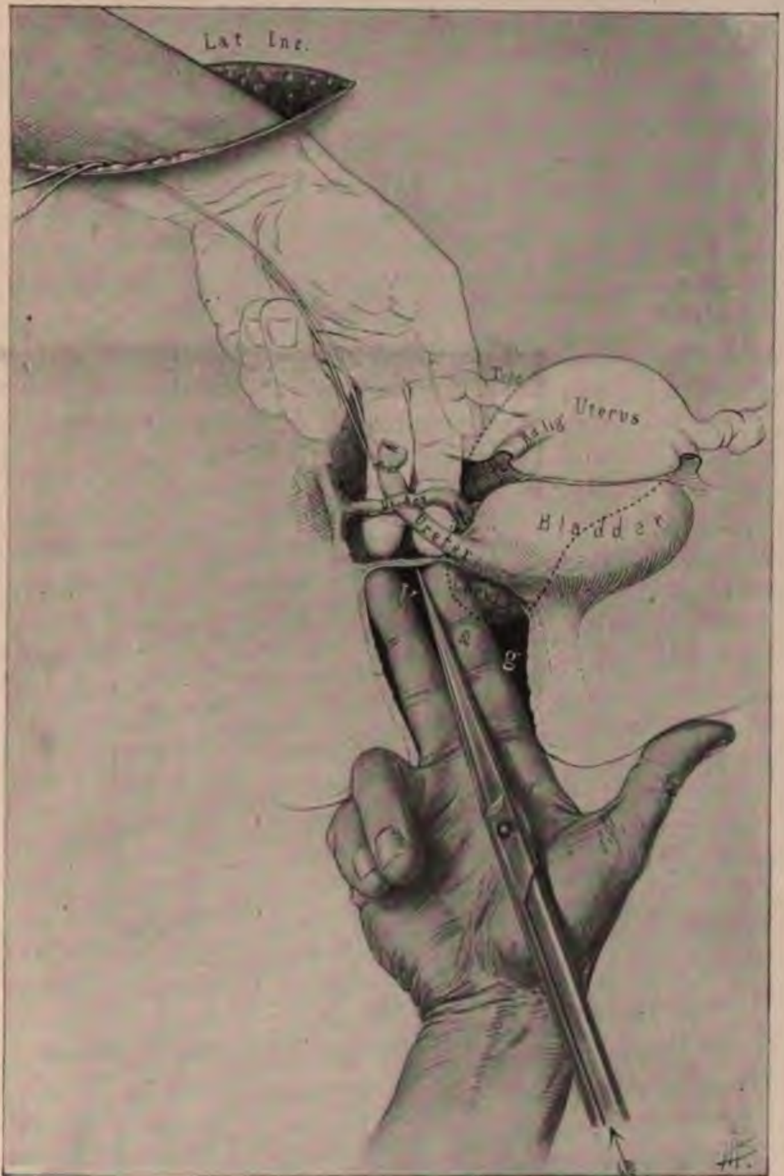


FIG. 310.—METHOD OF REMOVING THE LOWER END OF THE URETER THROUGH THE VAGINAL VAULT.

The upper hand introduced through the horizontal incision holds the ureter and lifts up the uterine artery, while the vaginal vault is opened by a pair of sharp-pointed scissors to allow the ureter to be drawn through. Third step.

At this juncture the ureter broke, about 6 cm. from the kidney; the lower end was at once caught in forceps and held, while by dint of pushing and working in my finger I succeeded in freeing about 2 cm. more of the ureter. Before doing this, however, I put a stout silk ligature over the abdominal end of the ureter, and by means of one hand in the pelvis and the other holding the long outside end of the ureter I succeeded in tying a knot about it, just behind the broad ligament; then, with a long pair of scissors, introduced through the abdominal incision and controlled by the hand introduced into the pelvis in the same way, the ureter was cut off half a centimeter above the ligature, after taking care to milk back any of its contents and to keep the upper end tightly squeezed until it was removed.

The vagina was now thoroughly disinfected, and, with the patient still lying on her left side, I passed two fingers of my right hand up to the vaginal vault, and with my left hand introduced into the pelvis through the abdominal incision, I brought both hands together with nothing but the vaginal tissue between them. I now made an opening in the vaginal vault, brought the end of the ureter through it and clamped it in a pair of forceps, until the abdominal wound was closed, when the vaginal end was removed also (see Fig. 310).

This opening was made in the following manner: I passed my entire left hand through the abdominal wound down into the pelvis and pressed the index and middle fingers against the right vaginal fornix, at the same time lifting up the uterine artery on the index finger so as to avoid any danger of cutting it; the end of the ureter lay between these fingers. The index and middle fingers of the right hand were now introduced into the vagina (the patient was lying in the left lateral posture) and pressed up against the fingers of the left hand in the abdomen, the palmar surfaces of both hands being turned upward. The opening in the vault necessary to draw the end of the ureter into the vagina was now made by the assistant, who introduced a pair of sharp-pointed scissors along my fingers up to the vaginal vault and pushed them through the thin septum, guided by my instructions; he then spread the blades of the scissors and withdrew them, in this way enlarging the hole in the vault to about 2 cm. The opening was situated about 2 cm. to the right of the cervix. The bleeding from this torn wound was venous and slight. With a pair of forceps pushed through this vaginal opening, the ligature attached to the end of the ureter was now caught, and the ureter drawn through the vagina and held there by forceps while the abdominal wound was being closed (see Fig. 311).

Closure of the Abdominal Incision.—The whole wound tract was first irrigated with normal salt solution. Although the bleeding was slight, a drain was put in, on account of extensive separation of the cellular tissues and the fear of the accumulation of the products of a serous weeping. The fascia and muscles were brought together by interrupted silver-wire sutures, with a gauze drain in the middle, while the fat and skin were closed by buried and subcuticular cat-gut sutures.

The condition of the patient was excellent, and the pulse as quiet as if no operation had been performed at all. I therefore did not hesitate to put her at once in the lithotomy position and proceed with the extirpation of the remainder of the ureter *per vaginam*. The end of the ureter and the hole in the vault were exposed by using retractors and catching the right side of the cervix with a bullet forceps and drawing it strongly to the left. By pulling on the forceps which held the ureter it was made tense, while I cut down through the vaginal wall, at first at the side between the anterior and the lateral walls, and then, curving the incision forward under the base of the bladder, to a point within $1\frac{1}{2}$ cm. of the end of the ureter in the bladder. The ureter broke off 3 cm. below the vaginal vault, and I had some difficulty in finding the short end in the tissue by the sense of touch and in grasping it with the forceps. There

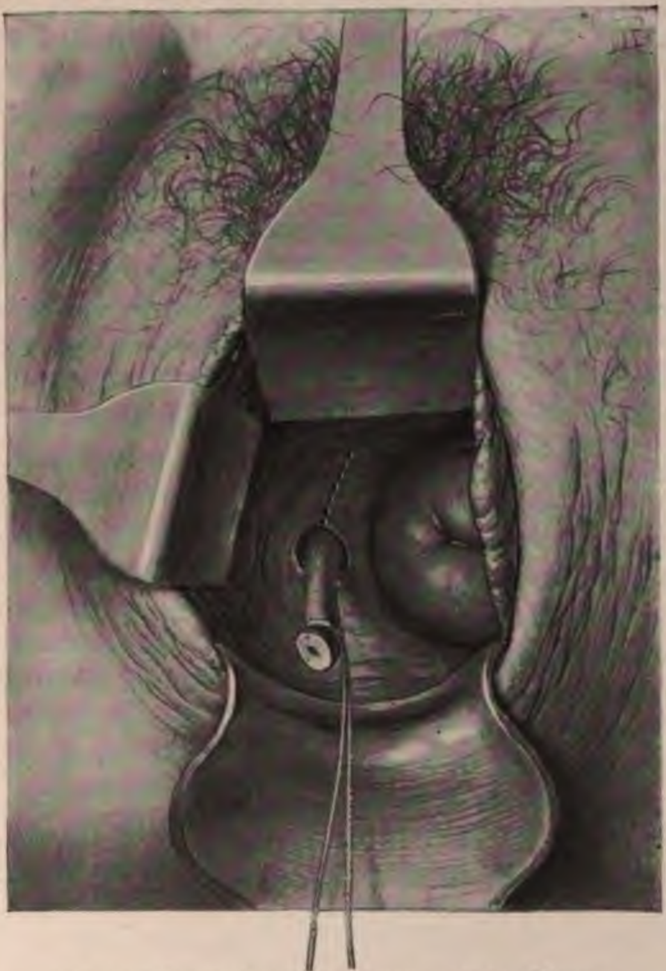


Fig. 311.—Removal of the Kidney with the Ureter.

The last step, the removal of the lower end of the ureter through the vagina. The ureter has been drawn through the opening made in the vaginal vault. The dotted line indicates the direction of the incision to expose the ureter down to its vesical extremity. Fourth step.

was a free venous oozing from the cut vagina below the vault. The ureter broke once more, and this time at its vesical extremity, and as I could not find the end again, I closed the wound and stopped the bleeding by introducing about six catgut sutures, tied tightly. The hole in the vault communicating with extensive cellular area above was left open for an inferior drain, which was now inserted, pushing a piece of iodoform gauze well up into the cavity and leaving its end hanging down in the vagina.

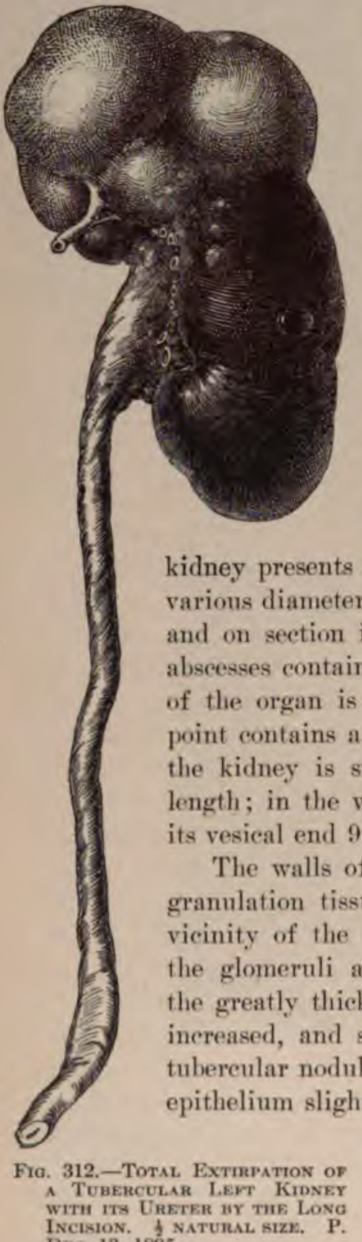


FIG. 312.—TOTAL EXTIRPATION OF A TUBERCULAR LEFT KIDNEY WITH ITS URETER BY THE LONG INCISION. ½ NATURAL SIZE. P. DEC. 13, 1895.

The recovery of this patient proceeded without a single unfavorable symptom, and she was well two years later.

Pathological Report.—The specimen in the third case (see Fig. 312) consists of the left kidney and ureter. The lower half of the kidney is 6.5 cm. long, 4 broad, and 5 thick. It is for the most part of a dark-red color, but on its anterior surface presents three pale, slightly elevated areas, composed of aggregations of minute yellow tubercles. The remaining portion of the kidney presents a lobulated appearance, and is 6 by 4.5 cm. in its various diameters. This portion of the kidney is soft and yielding, and on section is found to consist of three or four large caseous abscesses containing thick, creamy, odorless fluid. The lower half of the organ is in most parts normal in appearance, but at one point contains a caseous nodule 1 cm. in diameter. The pelvis of the kidney is smooth and glistening. The ureter is 19 cm. in length; in the vicinity of the kidney it is 5 mm. in diameter, at its vesical end 9 mm.; it is firm and somewhat rigid.

The walls of the abscesses are composed of typical tubercular granulation tissue, lined by caseous detritus. The tissue in the vicinity of the tubercular abscesses is greatly altered. Many of the glomeruli are completely hyaline, others are compressed by the greatly thickened capsule. The connective tissue is markedly increased, and scattered here and there throughout it are young tubercular nodules. The pelvis of the kidney has an intact surface epithelium slightly infiltrated with small round cells. The stroma beneath, however, shows marked small round-celled infiltration. Sections from the upper and middle portions of the ureter are also slightly infiltrated by small round cells. The ureter in the vicinity of the bladder, although dilated, is little altered. The ureter throughout its course shows no trace of the tubercular process. Tubercle bacilli were found in the wall of the caseous areas in the kidney.

Diagnosis.—Tuberculosis of the kidney.

The diagnosis in this and in the second case referred to was made by symptoms, by palpation, by inspection, and by the analyses of the separated urines.

The patients—all three—presented a history of pain in the side, extending down the course of the ureter and accompanied by frequent, painful micturition.

In the first case the renal symptoms were masked by the strangury in the bladder, due to cystitis and to some tubercle nodules.

In the second case the intense pain in the left side, and in the third case in the right side, accompanied in both cases by attacks of intense renal colic, pointed toward the chief focus of the disease.

In all cases palpation showed the pelvic portion of the ureter to be enlarged and thickened, but only in the first case did it show any nodular enlargement. There was also in each case a point of tenderness at the place where the ureter crosses the pelvic brim. It was also shown by palpation that the ureter of the opposite side was normal.

By inspection the bladder was shown to be normal excepting around the orifice of the ureter on the diseased side, where there was a reddened, granular, mammillated appearance.

The separated urines showed that the abnormal constituents of the urine came entirely from the side indicated by this appearance in the bladder, and that the opposite side was sound.

Tubercle bacilli were found in the first case after a patient search; in the second case bacilli, undoubtedly tubercle bacilli, were found which had some of the characteristics of the smegma bacillus. In the third case no bacilli were found, and the diagnosis depended upon the history and the physical examination. (See *J. H. H. Bull.*, Feb. and March, 1896.)

CHAPTER XIX.

THE USE OF THE X-RAY IN DETECTING CALCULI.

1. General considerations (p. 566).
2. Fluoroscopic method (p. 566).
3. Radiographic method (p. 567).
4. Chemical composition of calculi (p. 573).
5. Value of the X-ray method in diagnosis (p. 573).

General Considerations.—It is only within the last few years that the method of detecting renal, ureteral, and vesical calculi by means of the X-ray has received the attention it deserves. This neglect in the past is chiefly attributable to two causes, namely, the dread of an X-ray burn or of a dermatitis, and the disappointing results which have arisen from careless methods of making examinations. A careful analysis of all the reported cases of X-ray burns shows that almost all of them occurred in the early days of the method, or else that they were the result of examinations made by those not skilled in X-ray technique.

That an X-ray burn is an avoidable accident is shown by the fact that fewer burns are reported each year. There are two factors at work in producing this result, namely, improvement in technique and increased skill on the part of the operators. The unsatisfactory results arising from carelessly taken skiagraphs will also, in future, be avoided.

An X-ray examination of the kidney is not simply photographing it. Shenton says: "Such an examination is not merely photographing a patient's kidney—a foolish and prevalent expression—prevalent, because of want of knowledge generally among the profession of the things pertaining to the rays: foolish, because it is rare, in a skiagraph of the abdomen, to see the kidneys, for, as a rule, the less that is seen of the kidneys the more chance there will be of seeing a calculus." It must be remembered that the picture is not a photograph in the ordinary sense of the word, but a shadow picture. Though the picture itself is inaccurate as a representation of the object, yet it is an accurate presentation of the shadows of the different parts of that object, and the reasoning or conclusion drawn from it should be exact.

Examinations for renal calculi are of two kinds: the fluoroscopic and the radiographic, that is to say, what is seen upon the screen and what is discoverable upon the skiagraph.

Fluoroscopic Method.—Shenton is the chief exponent of this method, which he maintains is the more accurate and delicate means for the detection of calculi. The skiagraph, according to him, is merely a confirmatory test of the fluoroscopic method. He says: "One might draw a parallel between the faint shadows seen upon a screen and the faint sounds heard in a stethoscope. To the untrained eye and ear, neither have any significance, yet it is possible that a careful study of the ghostly screen effects may lead to a more delicate and perfect method of ascertaining the condition of the abdominal organs. However this may be, the search for calculus is an established and comparatively simple process."

Fenwick suggests the examination of the kidney fluoroscopically at the operation, while the kidney is lifted out of the incision. This procedure, however, as he points out, is not always admissible, as the blood vessels are sometimes too short to permit it.

Radiographic Method.—The radiographic method is that most commonly employed, and by most radiographers it is considered the most accurate. It is carried out as follows: Before making the examination the patient must be in a suitable condition. The bowels should be thoroughly evacuated and the meal preceding the examination must be a light one. The patient is placed in the dorsal position upon a hard table. The legs are slightly flexed so that the back may be brought as close as possible to the table. All clothing, both upon the back and abdomen, is removed to avoid the possibility of the shadow of some extraneous object, a button for example, being taken for the shadow of a calculus.

Some method of producing compression over the kidney region is frequently of value, especially in large subjects. Caldwell uses a simple device consisting of a thin rubber bag filled with air and covered by a fine netting. This is placed over the kidney, and by means of an adjustable canvas band any degree of compression may be obtained. The bag offers but little obstruction to the ray and probably compresses the contents of the intestines from those portions lying beneath the bag.

The plate is placed beneath the back and should be of sufficient size to cover both kidneys, as it sometimes happens that calculi are found on the side opposite to that in which the pain is felt.

The upper margin of the plate should reach the twelfth rib, and the plate itself should extend down far enough to receive the shadows of the portion of the ureters above the ilium. The tube is placed directly in front of the patient, over the median line just above the umbilicus, and from ten to fourteen inches from the abdominal wall. In this position the shadow of both kidney regions and the extra-pelvic portions of the ureters are obtained.

A second exposure should always be made, and in this the upper border of the plate should reach the crest of the ilium and its lower margin be below the trochanter. As before, the tube is placed in the median line, but this time it is half way between the symphysis and the umbilicus. In this position the rays fall in the line of the pelvic canal and thus the possibility of having the

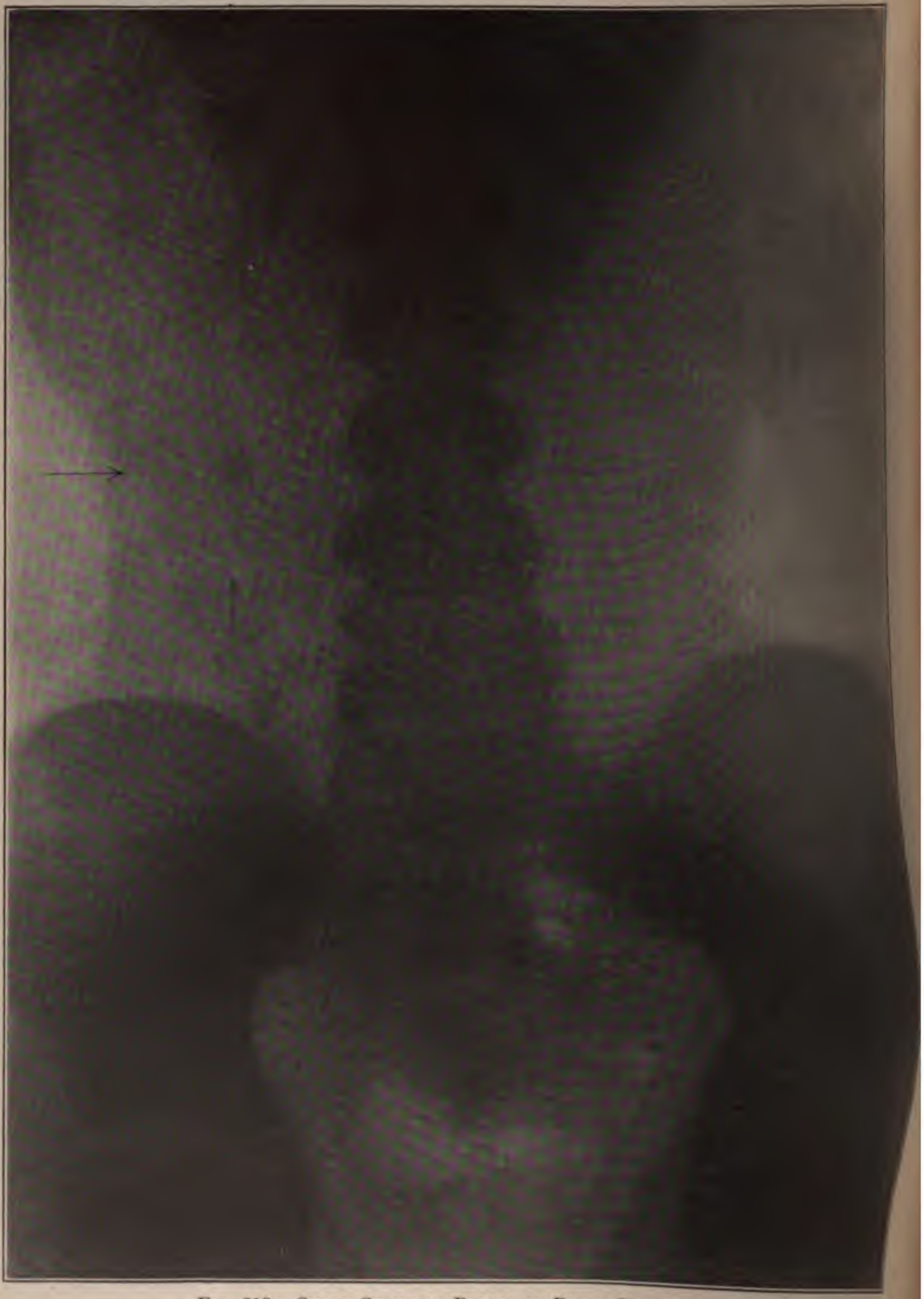


FIG. 313.—SMALL STONE IN PELVIS OF RIGHT KIDNEY.

ureters projected upon the sacrum is avoided. This second plate gives the portion of the ureters lying within the pelvis.

In the first position a good radiograph should show the twelfth rib, the transverse processes of the vertebræ, the crests of the ilia, and the psoas muscles. The second radiograph should show the sacrum, the inner border of the pelvic canal and the pubic spines. When these anatomical points are distinct in the skiagraph, sufficient differentiation has been obtained, as a rule, to determine the presence or absence of a calculus.

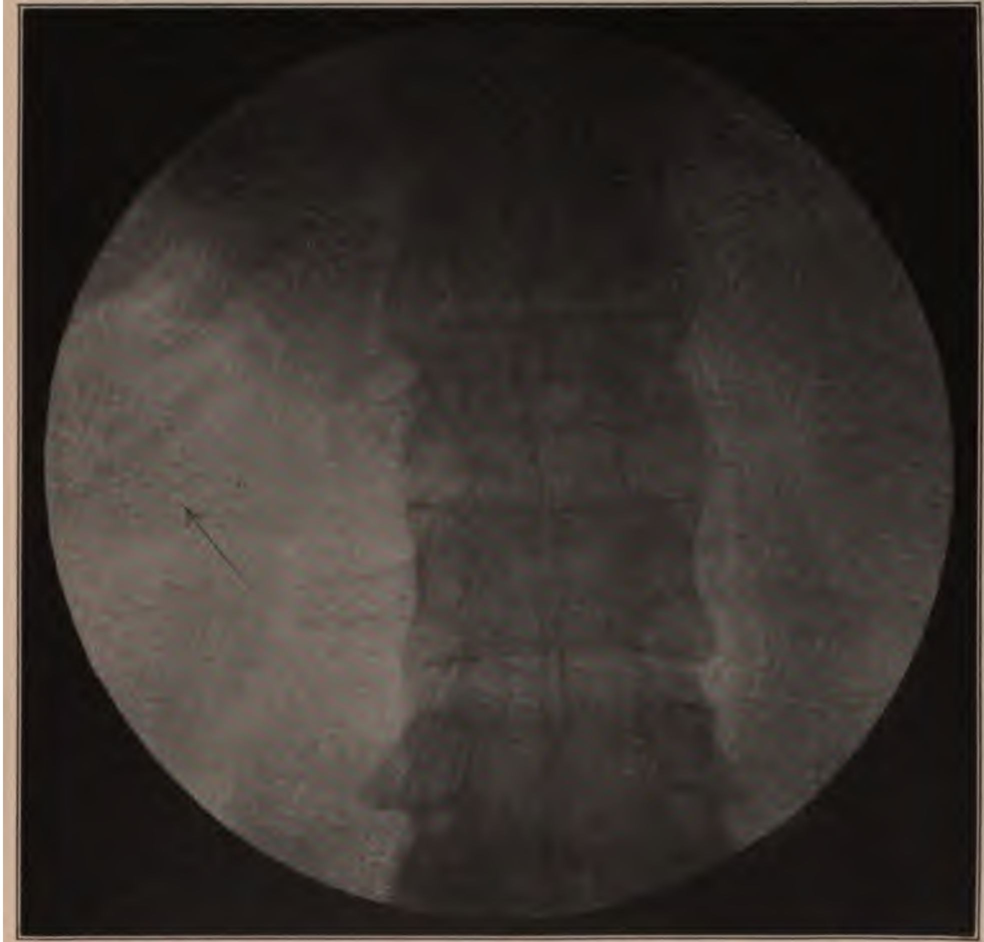


FIG. 314.—TWO CALCULI IN THE RIGHT KIDNEY. THE LARGER IS AN UNUSUAL SHAPE FOR A RENAL CALCULUS.

The most common situation for a calculus is in the angle formed by the last rib and the spinal column. A light shadow with rather a definite border in that situation should always be viewed with suspicion. Occasionally the shadow of a calculus will be found midway between the tip of the last rib and the crest of the ilium. In such cases the abnormal position is due to a prolapse of the kidney. Any suggestive shadow lying externally to the twelfth rib may

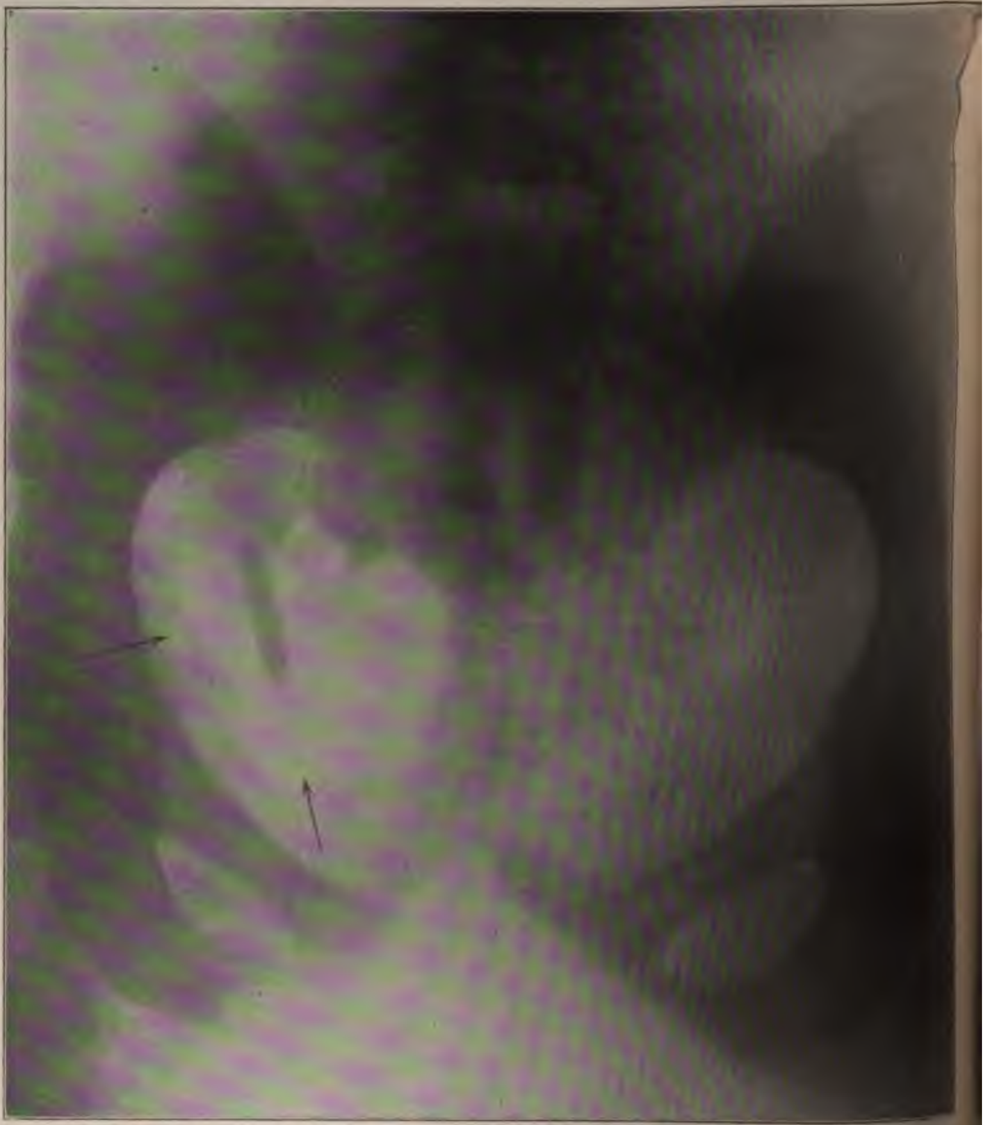


FIG. 315.—DATE-SEED CALCULUS IN RIGHT URETER JUST ABOVE THE URETERAL ORIFICE.

be disregarded as it is too far out to be in the kidney and is probably due to some shadow-casting substance in the intestines.

While, theoretically, ureteral stones may be found anywhere in the ureter, practically, they rarely occur except in the lower half inch of its extent. The presence or absence of these stones is determined by the skiagraph of the pelvis. A line drawn from a point half an inch internal to the pubic spine to the sacro-iliac articulation gives roughly the position of the ureter. A light shadow occurring in this line may be regarded as a calculus (see Fig. 315). Care must be taken, however, not to confuse such a shadow with one cast by a phlebolith. This region is richly supplied with veins and it is quite common for phleboliths to form in them. The shadows cast by these concretions, however, are more definite and their edges are more sharply defined; moreover, they are smaller, rarely exceeding 3 mm. in diameter. (Fig. 316.) Since the conditions which lead to the formation of phleboliths are usually present in all the veins in this region, these concretions are apt to be multiple. Where

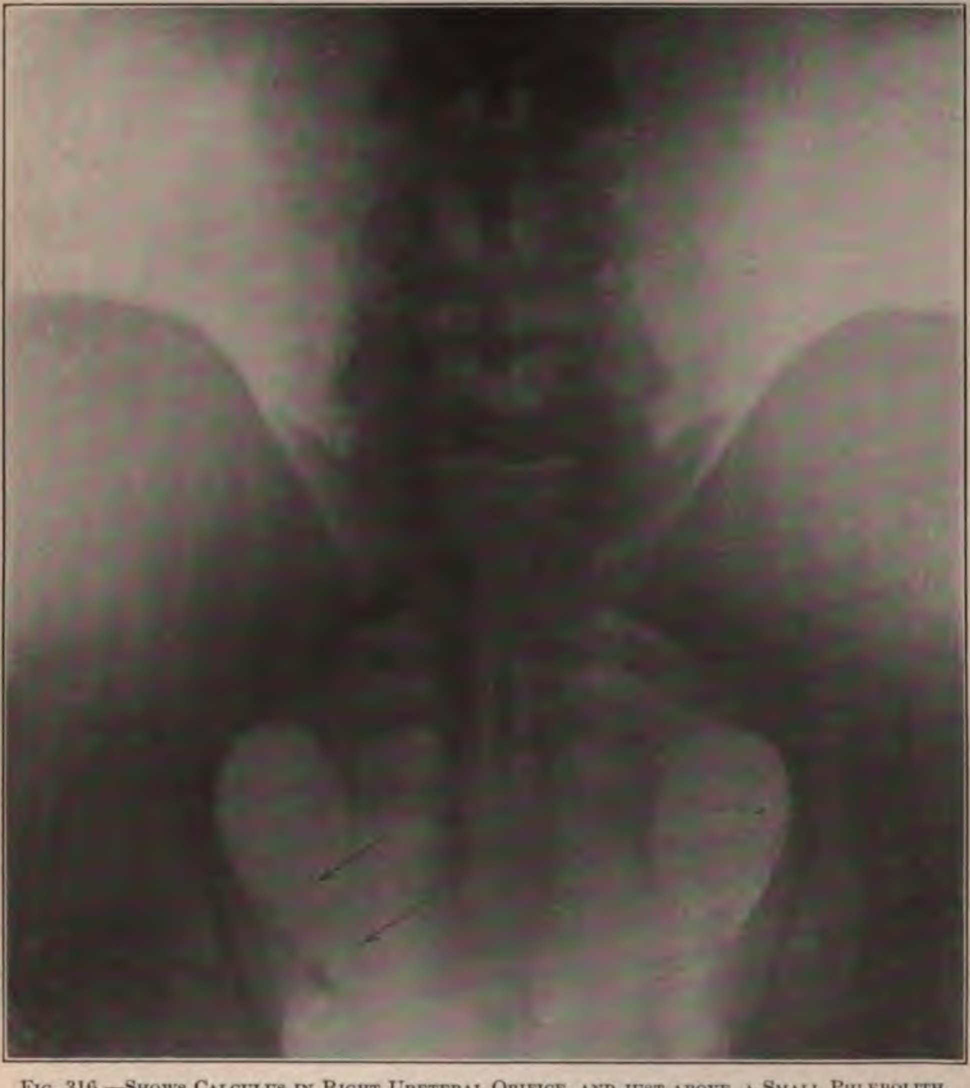


FIG. 316.—SHOWS CALCULUS IN RIGHT URETERAL ORIFICE, AND JUST ABOVE, A SMALL PHLEBOLITH.

the diagnosis is in doubt between the two conditions, the presence of one or more similar shadows elsewhere would indicate that the shadow in question was that of a phlebolith and not of a calculus; nevertheless, in some cases it happens that the diagnosis can only be settled by the ureteral catheter. Occasionally a calculus may be situated in some other portion of the ureter, and in such cases it will show as a light shadow about 1½ inches from the spinal

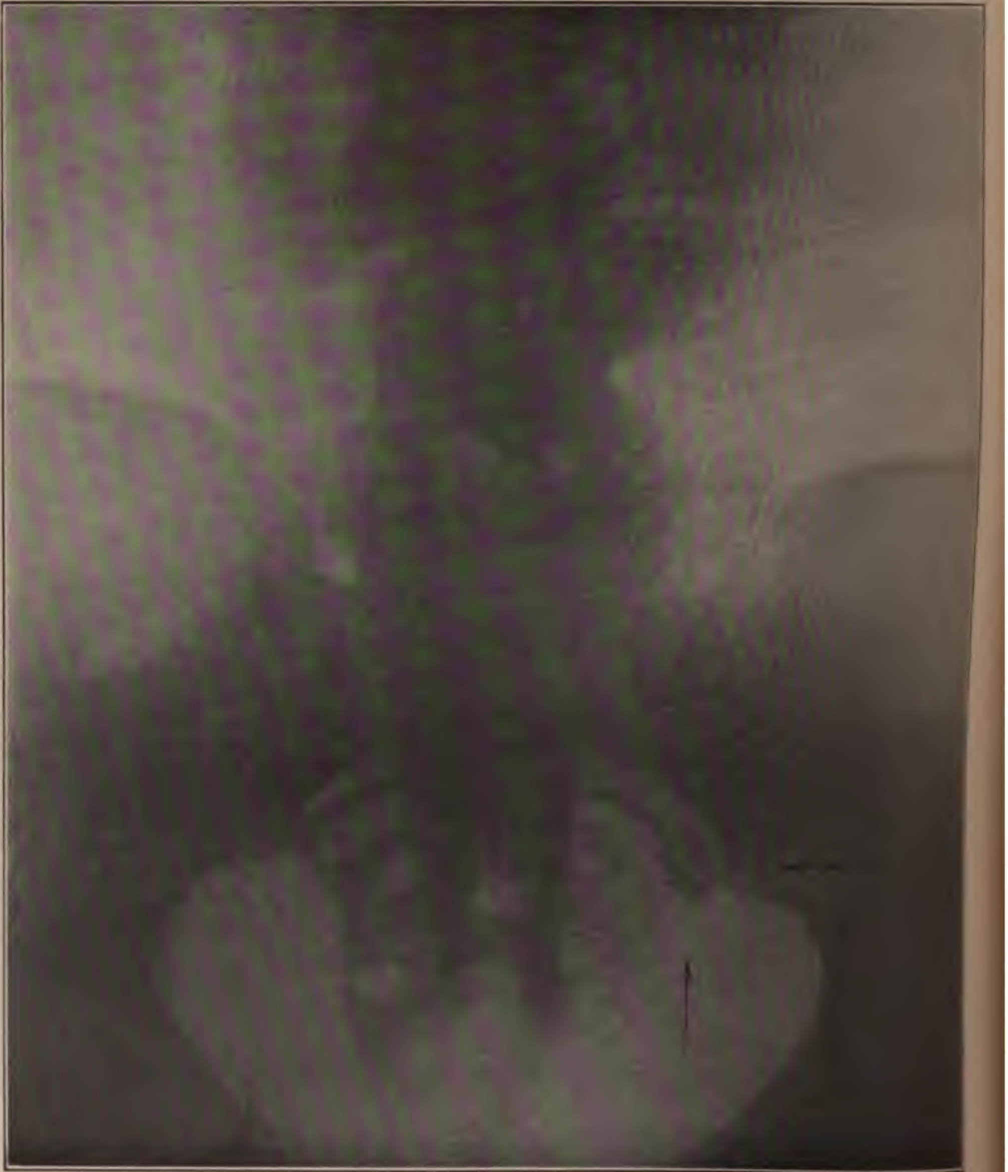


FIG. 317.—CALCULUS IN LEFT URETER JUST BELOW THE BRIM OF THE PELVIS.

column (see Fig. 317). Of the twenty-five cases of ureteral calculi found at the Johns Hopkins Hospital, in two only was the stone found above the brim of the pelvis.

Chemical Composition of Calculi.—Thus far the chemical composition of the stone has not been considered. As the sharpness of the shadow depends upon the density of the object skiagraphed, those which can best be represented consist, naturally, of oxalates, phosphates, and urates. If a specimen of each class is placed upon a photographic plate and a skiagraph taken of all three, it will be found that the oxalate casts a dense shadow; the phosphate, being more permeable to the rays, casts an indistinct shadow; while the translucent urate casts almost none. Thus, success or failure in a skiagraph is somewhat dependent upon the chemical composition of the stone and the greater or less opacity associated with it.

In the earlier days of this mode of examination, the detection of pure uric acid calculi was very uncertain. Now, however, with improvements in apparatus and in technique, and with the aid of special devices, such as the compression diaphragm, skiagraphs are obtained so rich in contrast and in detail that even uric acid calculi can generally be detected. The beautiful work of Leonard, Shenton, Beck, and others furnishes examples of this fact.

Value of the X-ray Method in Diagnosis.—While it is true that the percentage of failures in X-ray diagnosis is each year becoming smaller, it is, nevertheless, unlikely that absolute accuracy will ever be attained in this, any more than in other modes of diagnosis.

Mistakes in diagnosis fall into two classes: First, those cases in which the surgeon finds a calculus, but the ray does not; second, those in which the ray finds a stone, but the surgeon fails to confirm the diagnosis. Many failures result from improperly and carelessly taken skiagraphs. Detection of calculi is by no means easy, and accuracy can only be attained by careful work and long experience.

The part played by chemical composition in diagnosis has already been mentioned.

Size is also an important factor, since a calculus with a diameter of less than half a centimeter may easily remain undetected.

Even though the stone itself be of such size and chemical structure that its detection ought to be an easy matter, the physical condition of the patient may interfere considerably with the diagnosis, because since detection depends upon the differentiation of the calculus shadow from that of the tissues, it naturally follows that the greater the amount of substance through which the ray has to penetrate before reaching the calculus, the less contrast there will be between it and the tissues surrounding it. Consequently, in very fat individuals a small calculus might be easily overlooked.

An intestine filled with fecal matter may so obscure the renal region that it is impossible to locate a stone in that vicinity.

It may also happen that during an operation for calculus the manipulation of the kidney dislodges the stone and causes it to change its position. This is well illustrated by a case which came under the observation of Dr. F. H. Baetjer. A small calculus was found in the kidney by an X-ray examination. During the operation for its removal the surgeon experienced great difficulty in freeing the kidney and consequently the organ was freely manipulated. Finally, upon opening it, no calculus was found. The symptoms persisted, however, after operation, and a second skiagraph was taken. This time no calculus was found in the kidney, but one was lodged in the ureter just above the brim of the pelvis. Soon after the patient was seized with a violent attack of kidney colic, and in a short time she passed a small stone corresponding in size and shape to the one found first in the kidney and later in the ureter.

The salts of the heavy metals, such as bismuth subnitrate, cast quite dense shadows. One case has been reported in which a patient had been taking large doses of bismuth subnitrate. During the administration of the drug a skiagraph was taken and a diagnosis of renal calculus was made from a suspicious shadow in the kidney region. At that time the patient was not operated upon and some weeks later when a second examination was made no calculus was found. In this case the subnitrate in the intestines evidently cast the shadow which was taken for that of a stone.

A purulent exudate in the pelvis of a kidney, when inspissated and containing deposits of calcium salts, may cast a shadow indistinguishable from that of a stone. A patient was admitted to the ward of the Johns Hopkins Hospital with the diagnosis of renal calculus. The skiagraph showed a large, well defined shadow about 3 cm. in diameter in the left kidney. At operation, upon opening the kidney, pus was found encapsulated by fibrous tissue lined with a thin layer of calcium salts.

Dense cicatrices in the kidney cast suspicious shadows. The writer has seen one case in which the patient had had a severe infection of the kidney, and subsequently passed several small calculi. Two years after the infection the patient had attacks of renal colic and a skiagraph was made. In the kidney on the affected side three distinct and well defined shadows could be seen. With the history of having passed calculi a definite diagnosis of renal stone was made. At operation, however, no calculi were found; there was, however, a small contracted kidney, and in it were masses of dense cicatricial tissue which had cast the misleading shadows.

In this connection it may be well to consider briefly the use of the wax tipped catheter as an aid to the X-ray diagnosis. In many of the cases just cited the use of the wax tip would materially aid in the diagnosis. With a shadow in the skiagraph and a scratch on the wax there could be no doubt as to the diagnosis.

As already pointed out, a small stone just in the ureteral orifice may be mistaken for a phlebolith. In such cases the wax tip alone can settle the question. Then, too, the skiagraph may show a slight shadow, which of itself is not sufficiently definite to justify the diagnosis of a stone. If, however, the wax tip shows a scratch, the diagnosis is made secure.

On the other hand, in some cases a stone may be present and yet not be revealed by the wax tip. The following case demonstrates this point very well:

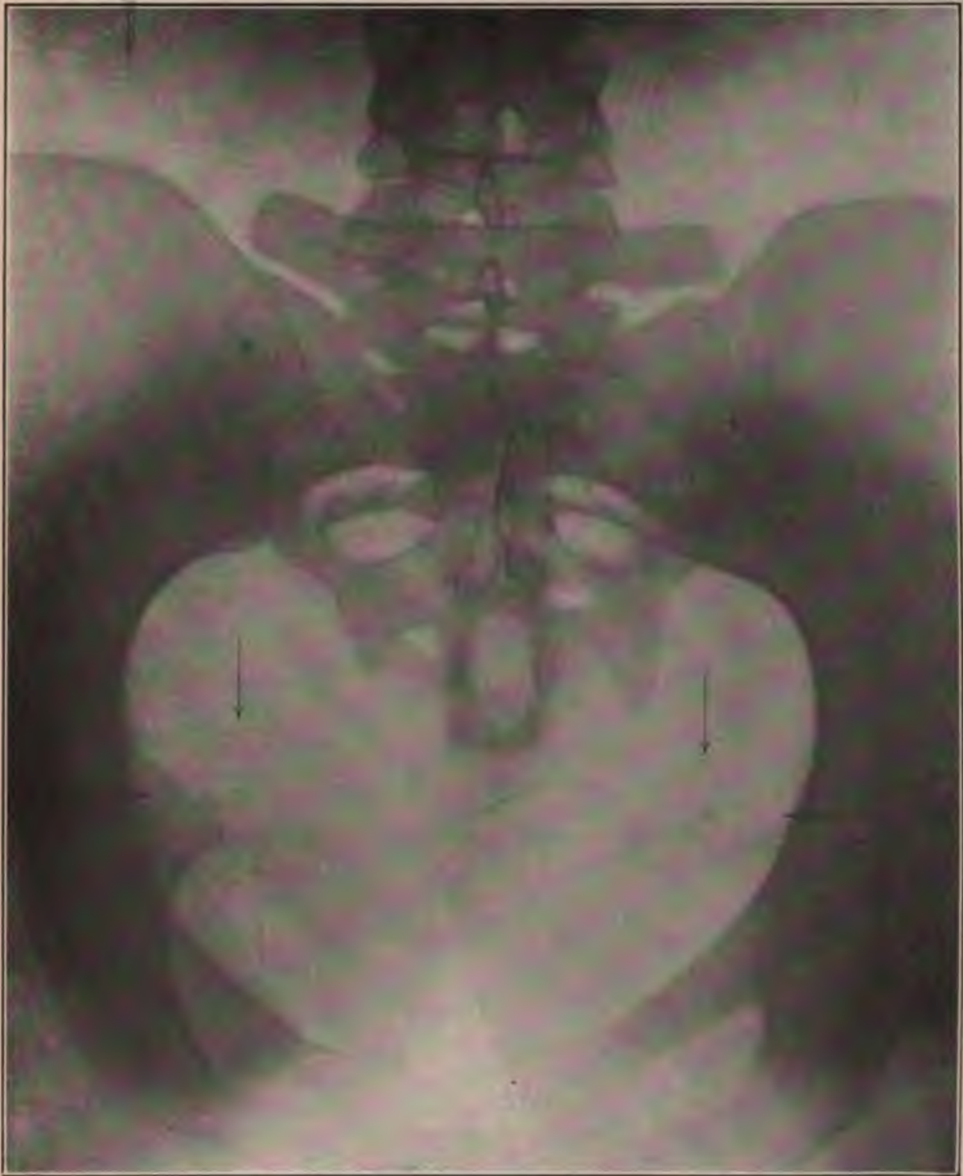


FIG. 318.—PHLEBOLITHS LYING NEAR THE URETERAL ORIFICES, WHICH MIGHT BE MISTAKEN FOR CALCULI.

A patient was admitted to the ward at the Johns Hopkins Hospital with a definite history of renal colic. The skiagraph showed a stone 1 cm. long by

½ cm. in diameter, just back of the ureteral orifice. A catheter could be introduced into the ureter with ease and no scratch obtained. At operation the ureter was found to be enlarged and sacculated at that point and the stone was lying in a pouch so situated that the catheter had passed over it.

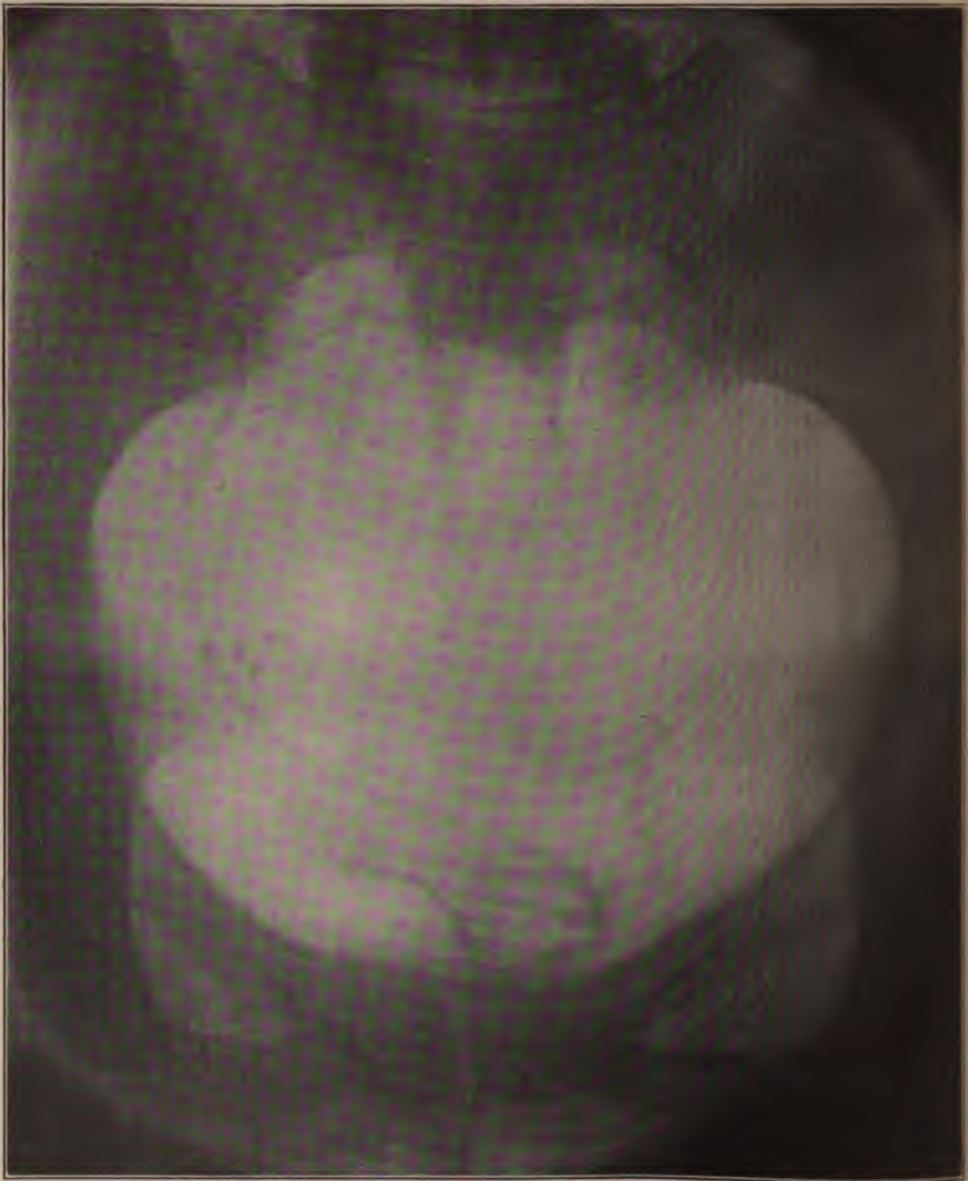


FIG. 319.—A GROUP OF PHLEBOLITHS AROUND THE RIGHT URETERAL ORIFICE. Shadowgraph catheter in ureter shows one phlebolith to be directly beneath the ureter.

The X-ray has the advantage in that it gives the size, shape, position, and number of the stones. The wax tip simply reveals the presence of a stone, but gives no indication as to its size or shape. It may, however, show the presence of a small stone which the X-ray failed to detect.

As can be readily seen, the X-ray and the wax tip act as a check upon each other. Both methods should be tried and when they agree there can be no doubt as to the diagnosis.

The question naturally arises: In what percentage of cases does the use of the X-ray afford positive diagnosis of the presence or absence of a stone? Opinions in regard to this point vary, some radiographers maintaining that an absolute diagnosis, either positive or negative, can always be made; others holding that the diagnosis is very uncertain. The personal equation enters so largely into the question that an absolute standard cannot be fixed.

From the series of cases examined at the Johns Hopkins Hospital, certain data may be cited which indicate the value of this method of examination, although they are not to be regarded as statistical evidence.

In this series of cases there were some in which the skiagraph showed that calculi were present where the clinical signs barely suggested the possibility of such a condition. There were others in which the patient had had no symptoms in the least suggestive of calculus, and the examination was, as it were, accidental. There was still another class, and this is the most interesting, in which the symptoms pointed so strongly to calculi that an X-ray examination was almost deemed unnecessary, yet neither the skiagraph nor the surgeon were able to demonstrate the presence of calculi. In the past two and a half years 217 cases have been examined for renal or ureteral calculi. In 61 cases calculi were found by the ray; 39 of these were operated upon, and the diagnosis confirmed by the surgeon. The remaining 29, for various reasons, have not been subjected to operation.

Of those in which a negative diagnosis was made, 40 were explored and in one case only were calculi found. The remaining 116 cases were not explored, but subsequent history seems to confirm the negative diagnosis.

From these figures, it will be seen that the positive evidence is almost absolutely reliable; the negative not entirely so. However, the negative evidence is entitled to weight in the absence of symptoms definitely indicating the presence of stone.

In conclusion it may be said that with good apparatus and technique, calculi, when present, can almost always be found. The X-ray examination gives definite and positive information as to the location, the size, and number of calculi present. It also shows the position of the calculi, and decides definitely whether it is in the kidney or ureter. This simplifies the operation and when more than one stone is present, the surgeon is less likely to overlook the fact.

In suspected cases an X-ray examination should always be made. It is not dangerous, and gives no discomfort to the patient.

Indirectly, the examinations are of great benefit to the diagnostician as they enable him to define more sharply the group of symptoms associated with the presence of the calculi. Williams ably presents this phase of the question as follows: "X-ray photography will not only be a means of pointing out calculi directly, as indicated, but eventually will also be of service by pointing them out indirectly, for they will instruct the profession more exactly in regard to the symptoms which calculi produce. That is to say, the X-rays by giving more definite information than hitherto of a calculus in the kidney, for example, will enable the physician to associate characteristic groups of symptoms with its presence that he is not now able to connect definitely with the disease. In this way the X-rays will increase the possibility of making a tentative diagnosis without an X-ray examination and more cases will be recognized."

CHAPTER XX.

DILATATION.—CURETTAGE.—EXPLORATION OF THE UTERINE CAVITY.—REPAIR OF CERVICAL LACERATIONS.

1. Dilatation (p. 579).
2. Curettage (p. 584): 1. Preparation and examination of uterine scrapings. 2. Normal uterine mucosa. 3. Acute endometritis. 4. Chronic endometritis. 5. Decidual endometritis. 6. Mucous polypi. 7. Remnants of abortion. 8. Tuberculosis of the endometrium. 9. Carcinoma of the body of the uterus. 10. Adeno-carcinoma of the body of the uterus. 11. Sarcoma of the uterus. 12. Curettage for cancer of the cervix: *a*. Epithelioma of the cervix. *b*. Adeno-carcinoma of the cervix.
3. Exploration of uterine cavity (p. 596).
4. Repair of the lacerated cervix (p. 598).

DILATATION.

THE cervical canal is dilated for the relief of dysmenorrhea, for the purpose of removing portions of the endometrium or the remains of an incomplete abortion, and to overcome sterility.

For dysmenorrhea, the operation of dilating the cervix does not yet stand upon a scientific basis, as its mode of action is not clear and the results are far from uniform. While a small percentage of cases are cured, and a larger percentage are relieved, still a considerable number are not in the slightest degree benefited. A common cause of failure is a want of care in selecting suitable cases. The general practitioner, and even many specialists, fall into a common error of beginning the treatment of all cases of dysmenorrhea by a dilatation, without a proper preliminary search for other causes of pain, such as tubal and ovarian disease, pelvic peritonitis, and the presence of small fibroids in the uterine walls. It must not be forgotten that dysmenorrhea is but a symptom common to a number of diseased conditions, and to make clear its relation to a variety of pelvic affections which are most apt to escape detection upon a superficial examination, I have analyzed 255 of my cases of pelvic peritonitis with adherent ovaries and tubes, tubercular peritonitis, hydrosalpinx, pyosalpinx, and catarrhal salpingitis, taken consecutively. Of these 255 cases, 185 suffered from dysmenorrhea, and it was absent in but 70 cases; therefore, from this analysis it would appear that 72 per cent of pelvic inflammatory cases present dysmenorrhea merely as a complication.

In spite of failure, even in many of the well-selected cases, the relief and the occasional cures effected make dilatation one of the most important, and often one of the most satisfactory, of all the minor gynecological procedures.

The most suitable cases for dilatation are those in which the pain is spasmodic, begins with the flow, and is most intense during the first day or two.

Operation.—Dilators of the Goodell-Ellinger pattern, of three sizes, are needed; the smallest, having smooth blades, is 4 mm. in diameter, and the two larger 5 and 6 mm. in diameter, respectively, both corrugated, as recommended by the late Dr. William Goodell (see Fig. 320). My own dilators have a spring between the handles, but are not provided with ratchet or screw. The handles are bent at an angle and made large enough to be grasped in the full hand; the dilating end is blunt and but slightly curved (Fig. 321). Light instruments with a strong curve and a tapering point are dangerous and must be avoided.

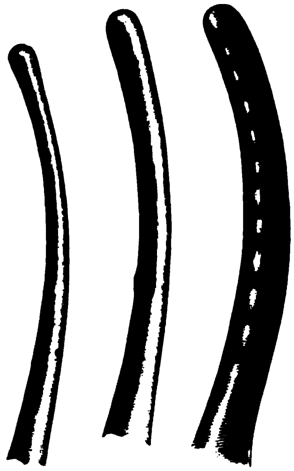


FIG. 320.—THE DILATING ENDS OF THE THREE SIZES OF THE ELLINGER AND GOODELL-ELLINGER DILATORS, SHOWING THE SLIGHT CURVE AND RELATIVE SIZES. ORDINARY SIZE.

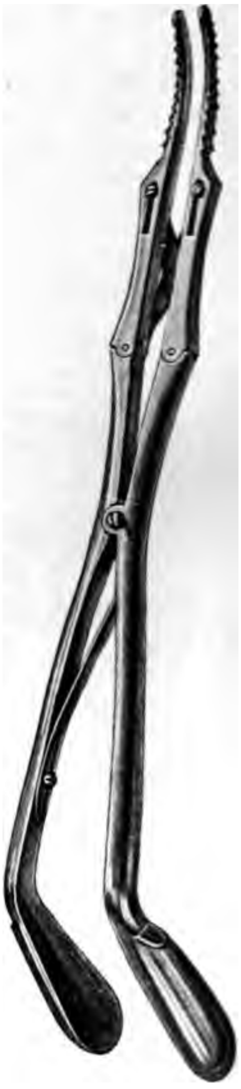


FIG. 321. — GOODELL-ELLINGER DILATOR, WITH SPRING BETWEEN THE HANDLES, BUT WITHOUT A RATCHET.

The corrugations on the blades prevent slipping during the dilatation. ½ ordinary size.

Slow dilatation by means of sponge or tupelo tents, formerly so much used, has, by common consent, been generally abandoned on account of the great danger of septic infection. The uteri, which need dilatation and curettage, are often already infected, and the use of a hard foreign body, which bruises and lacerates the tissue and makes a constantly increasing firm pressure, seems to offer just those conditions which are most favorable to the rapid introduction of pathogenic organisms into the system. In many instances the patient survives such a treatment with a chronic pelvic inflammation. Two such cases have come under my notice recently; one lady, a prominent member of society, died, and the other would have done so if she had not been promptly relieved by skillful surgery.

The first case was examined by my assistant, Dr. T. S. Cullen (*Johns Hopk. Hosp. Rep.*, vol. vi, Path. No. 869). Criminal abortion had been induced in the fourth month of pregnancy and the patient died of a septic peritonitis in sixteen days. At the autopsy the peritoneum contained several quarts of purulent fluid, and the enlarged soft uterus was removed. On section its walls were found to contain numerous small abscesses; the alcoholic specimen measured 13 by 9 by 6 cm.; its cavity was 9 cm. long and contained six pieces of wood (parts of an elm tent), which, united, formed a perfect cone with a hole perforating its base. The uterine walls were extensively necrotic, and cocci were found everywhere in the vessels and in the thick sheet of fibrin which covered the uterus.

In another case, the physician in attempting to induce an abortion, thrust a wooden tent through the posterior wall of the uterus into the peritoneal cavity; the tent entered the uterine wall at its junction with the cervix, and transfixed it obliquely, emerging through the peritoneal surface near the fundus. The patient was brought to Dr. W. E. Ashton, of Philadelphia, who opened the abdomen (March, 1889) and removed the uterus, tubes, and ovaries. The patient recovered.

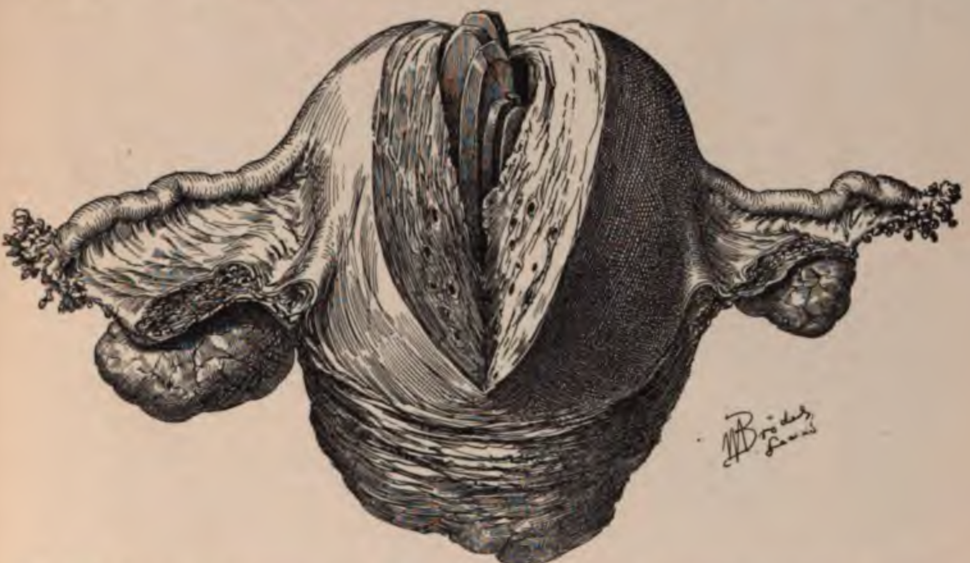


FIG. 322.—CRIMINAL ABORTION, WITH SEPARATED ELM TENT *IN SITU* PARTIALLY PERFORATING THE UTERINE WALL. SEPTICEMIA AND DEATH. SPECIMEN REMOVED AT AUTOPSY.

The antiseptic preparations for dilatation and curetting consist in a thorough preliminary cleansing of the vagina, as described in Chapter XII.

I always precede dilatation and curettage by a careful bimanual examination to determine the condition of the organs and the exact position of the uterus. If the direction of the uterine canal is known it aids greatly the introduction of the uterine dilator.

In the virgin the index finger must be introduced into the vagina slowly and gently, to avoid injuring the hymen. When the finger touches the cervix a pair of tenaculum forceps is introduced and the cervix firmly grasped by its anterior lip. The finger is now withdrawn and traction made with the forceps until the os uteri is seen at the vaginal outlet.

When the orifice is small, or the examining finger large, in order to avoid injuring the hymen the position of the cervix must be determined, without vaginal examination, by a careful rectal palpation; the tenaculum forceps is now introduced into the vagina, and, under the guidance of the rectal finger, the anterior lip of the cervix is cautiously caught and drawn down to the outlet.

In married women and those who have borne children the posterior vaginal wall may readily be retracted by a Sims or Simon speculum, or indeed with two fingers, exposing the cervix, which is grasped with the tenaculum forceps and drawn down.

The smallest dilator is now taken up, poised delicately between the fingers just like a pen, and gently introduced within the external os, and pushed up the canal to the internal os. The dilator must never be grasped with handles braced against the palm of the hand and forced through obstructions. When resistance is encountered, as it commonly is, in passing from the internal os into the uterine cavity, the dilator must be withdrawn a little and gently coaxed up in a slightly different direction, until by repeated efforts, without force, it finally passes the obstruction and slips in.

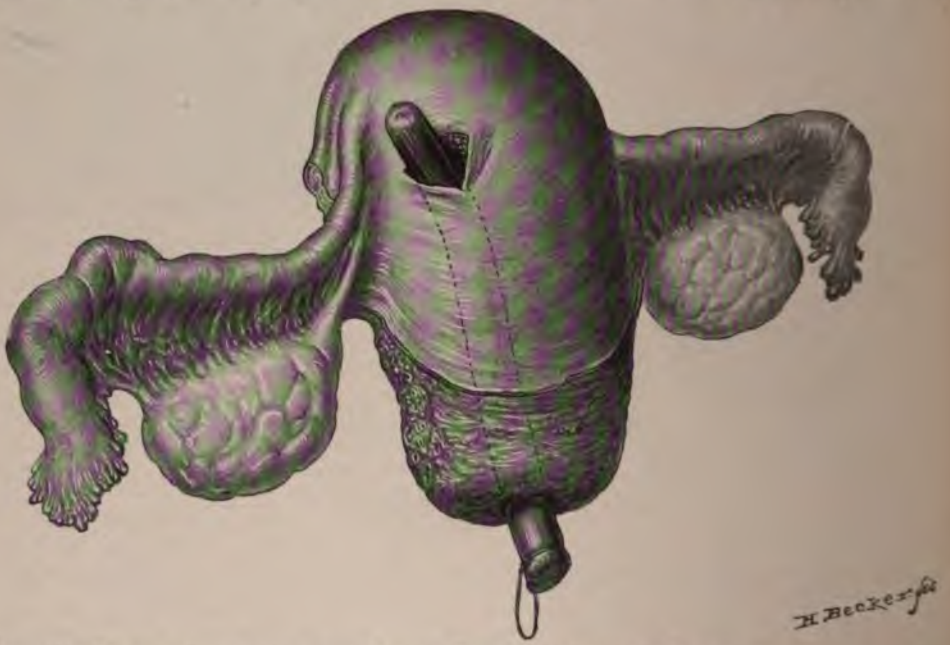


FIG. 323.—UTERUS PERFORATED BY A TUPELO TENT. PERITONITIS, HYSTERO-SALPINGO-OÖPHORECTOMY, RECOVERY. OP. BY DR. W. E. ASHTON.

I have seen a death result from neglect of this precaution together with the use of a sharp dilator (see *Amer. Jour. Obs.*, Jan., 1891). The surgeon pierced the posterior wall of the anteflexed uterus at its cervical junction, and tore a wide hole into the peritoneum. He then inserted a coarse sponge tent into the cervix, which projected partly within the peritoneal cavity. The patient died in a few days of peritonitis, in spite of an effort which I made to save her by opening and draining the abdomen. The risk of perforating an anteflexed uterus in this way is so manifest that I can not escape the conviction that such an accident has happened more frequently than is commonly supposed.

With the blades of the instrument well introduced, I dilate the canal first in one direction, then on relaxing the pressure the blades close, and I rotate the dilator a little, gently dilating another portion, and so on, continuing all around the circle back to the first point. The cervix, yielding to these repeated gentle impacts from within on all sides, gradually and equably dilates to the necessary degree without laceration. In this way in a minute or two the canal opens up enough to admit a larger corrugated dilator, with which the dilatation is continued in like manner from side to side, antero-posteriorly and at all points between. This extent of dilatation, large enough to allow the introduction of a bougie 1 cm. in diameter, is usually sufficient for the relief of dysmenorrhea or for curettage. A somewhat greater dilatation may be secured by using the largest-sized dilator, but not without risk of too great injury to the cervix. It is unjustifiable to attempt to dilate a cervical canal sufficiently to permit the introduction of the index finger into the uterine cavity, for such a degree of dilatation can only be effected by extensive rupture of the cervix.

Such a method of dilating, by repeated impacts on the cervical canal from all directions, is far better than the common method of opening a dilator controlled by a ratchet or screw, and expending all the force in one direction, until the cervical fibers split and a tear is produced. The objections to this method are the damage done the cervix, the greater danger of septic infection, and the scar left when the rent heals, with the possibility of a carcinoma.

While the operation of dilatation and curettage is usually considered a safe procedure, and is followed by little or no mortality, it may have decided dangers which must be considered.

Normally, the uterine wall is firm and resistant, and even marked pressure made upon it by the sharp curette would not be sufficient to perforate its walls; but occasionally the muscular tissue is thin and friable, and even the slightest pressure suffices to cause a rupture. This is especially liable to occur in curettage after abortion or in septic cases. I have known of three deaths occurring in young women from peritonitis produced by perforation with a curette, and several dreadful accidents have been recorded.

In a case of tuberculosis of the uterus, occurring in my service at the Johns Hopkins Hospital, the cervix was ruptured by the dilator laterally into the broad ligament and then into the peritoneum, so that a portion of the omentum escaped through the opening. The cervix had been but moderately dilated, when, on starting to curette, the tip of the omentum was seen projecting from the cervix, at once revealing the character of the accident. Abdominal section was at once performed, the prolapsed omentum withdrawn, and the opening into the broad ligament sutured. An unsuspected general tuberculosis of the peritoneum, with tubercular appendages, was then discovered. The appendages were removed, and the patient made a good recovery. In this case the uterus was thin and softened by the tubercular process.

In case of perforation of the fundus by the curette, there are two plans of treatment feasible—either to pack the uterine cavity with gauze and allow the opening to close of itself, or to open the abdomen and suture the rent with catgut. Unless the rupture is extensive, I advise the former course; if there is any escape of bowel or omentum it will be safest to do a celiotomy.

Perforation of the fundus with a uterine sound has occurred six times in my personal experience without any serious trouble following the accident, but death from peritonitis followed in a case in the hands of one of my assistants.

In a case seen by Dr. M. D. Mann, of Buffalo (*Amer. Jour. of Obs.*, 1895, p. 603), a young practitioner forcibly dilated the cervix in order to remove the ovum in an early abortion, which the patient had induced by means of a catheter. In using a sharp curette and his finger, after clearing out the ovum, he caught hold of and tore a loop of the intestine. Dr. Mann was called in within an hour and a half, opened the abdomen, and found a hole in the center of the fundus of the uterus large enough to admit the finger; the ileum was divided close to the ileo-cecal valve, and was separated from its mesentery fully six inches; the head of the colon was bruised and infiltrated, and the abdomen contained some blood and feces. The patient recovered after the closure of the hole in the uterus, and the inversion of the head of the colon, followed by the removal of the detached bowel and the making of a new ileo-colic anastomosis with a Murphy button.

Dr. J. B. Harvie, of Troy, N. Y., had personal cognizance of a case in which, after dilating the uterus, a young practitioner passed in a pair of forceps to catch the ovum and drew out and cut off six feet of bowel (!) without realizing what he had done.

In a similar case of extensive intestinal injury following the perforation of the uterus with a curette, Dr. C. P. Noble, of Philadelphia, opened the abdomen and resected three feet of the small intestine successfully.

CURETTAGE.

Curettes are used to remove the superficial portions of the uterine mucosa in endometritis; to secure bits of tissue for diagnostic purposes in suspected cancer of the body; to remove portions of an ovum incompletely cast off, and septic matter after childbirth; and to clean out the broken-down tissue of a cancerous cervix where the disease has progressed beyond hope of a radical cure. Sharp curettes, handled with extreme delicacy, are most serviceable; the blunt curettes, often advocated, are but insufficient substitutes.

A careful microscopical study of the tissue should follow the removal by the curette in every case, and the following conditions should be looked for:

Normal uterine mucosa.
Acute endometritis.
Chronic endometritis.
Endometritis decidualis.
Mucous polypi.
Remnants of abortion.
Tuberculosis of the endometrium.
Carcinoma of the body of the uterus.
Sarcoma of the uterus.
Cancer of the cervix.

Preparation and Examination of Uterine Scrapings.—In examining portions of the endometrium I use the formalin method introduced by Dr. T. S. Cullen (*Johns Hopk. Hosp. Bull.*, April, 1895), which obviates the tedious delays of ten days or two weeks incident to older methods of preparation and permits a diagnosis to be made within fifteen minutes—that is to say, while the patient is still under anesthesia; a radical operation may then, if necessary, be performed at once.

The procedure is the following:

(a) Place frozen sections of the fresh tissue in a 5 per cent aqueous solution of formalin for from three to five minutes.

(b) Immerse in a 50 per cent alcohol solution for three minutes.

(c) Place in absolute alcohol one minute.

(d) Wash in water.

(e) Stain in hematoxylin for two minutes.

(f) Decolorize in acid alcohol.

(g) Rinse in water, to which Dr. T. R. Brown has recently recommended the addition of two or three drops of ammonia, which rapidly brings back the characteristic hematoxylin color.

(h) Stain with eosin.

(i) Transfer to 95 per cent alcohol.

(j) Pass through absolute alcohol, creosote, or oil of cloves, and mount in Canada balsam.

A cylinder of condensed carbonic acid gas is kept in a room adjoining the operating room, in order to facilitate the immediate making of the frozen sections, to be passed at once through the routine described.

By securing an early diagnosis in this way the patient is often relieved of the necessity of taking an anesthetic twice, and cases arriving from a distance save from ten days to two weeks of their time in the hospital.

It is easier to cut fine sections after the tissue has been first hardened in the formalin, according to the second plan also recommended by Dr. Cullen, as follows:

The scrapings are placed immediately in a 10 per cent formalin solution, kept in small specimen bottles, always at hand. Within two or three hours they are sufficiently hardened to cut readily, when frozen sections are made and left in a 50 per cent alcohol solution three minutes, and the succeeding steps taken as described above.

The curetted specimens should be placed in a bottle by themselves and labelled at once; when the sections are cut, no similar open dishes containing other sections should be lying about, nor should the sections under consideration be passed through the fluids together with other sections, in order to avoid the terrible mistake of confusing two cases, and so drawing erroneous conclusions. In all my experience of many hundreds of examinations this accident has happened once.

The patient had a uterus of normal size, and was nearly exsanguinated by protracted excessive hemorrhages. I operated upon her for a cancer of the body of the uterus, diagnosed from curettings. Upon opening the abdomen I found not a cancer, but a small pedunculate fibroid tumor, lying in the cervix, which had not been felt during the curettage upon which the diagnosis had been made. It was afterwards discovered that the scrapings had been mixed with those from another patient.

Normal Uterine Mucosa.—The standard of comparison for all curetted specimens is the normal uterine mucosa; this presents, microscopically, an even surface covered by a single layer of cylindrical ciliated epithelium. The glands are round or oval on cross section, and in a few places may be seen opening on the surface.

They are usually equidistant, and are lined with one layer of cylindrical ciliated epithelium; hence they appear as reduplications of the surface epithelium. An occasional bifurcation is seen in the deeper portion of the gland. In the floor of the gland there is not infrequently a small tit-like ingrowth. Lying between the glands is found the stroma of the mucosa, or so-called lymphoid tissue. The cells, however, are much larger, and on close examination bear no resemblance to lymphoid tissue; the nuclei of the stroma cells are oval, vesicular, and appear to best advantage in specimens hardened in Müller's fluid. The arteries of the stroma are usually found in small bunches; the veins are large, single, and thin-walled.

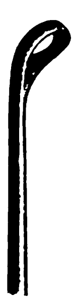


FIG. 324.—SHARP CURETTE FOR REMOVING THE UTERINE MUCOSA. ORDINARY SIZE.

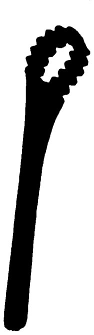


FIG. 325.—SERRATED FENESTRATED CURETTE.

The serrations should be made rather sharp, and a little deeper than shown.

The blood in the veins is separated from the stroma cells by but one layer of endothelium. The line of demarcation between the mucosa and the muscle is usually well defined; occasionally, however, a gland penetrates the muscle for some depth, when it is invariably accompanied by a considerable amount of stroma. This dipping of a gland into the muscularis must not be mistaken for a pathological condition.

Endometritis.—Curettage for endometritis follows immediately upon dilatation, and is performed in this way: The sharp perforated spoon curette, poised between thumb and the first and second fingers, is easily introduced through the dilated canal. The whole inner surface of the uterus over the fundus and from fundus to cervix is now carefully scraped, completely removing the superficial portion of its lining membrane in strips and short pieces. The sound basis is recognized by its greater resistance, and a slight grating sensation communicated to the fingers. The separated lining membrane is expelled through the cervix by a series of intermittent uterine contractions; its discharge may also be assisted by using the curette to scoop it out. The hemorrhage after this operation is never serious enough to call for measures to control it. The patient should be kept abed from three days to a week; it has never been my practice to introduce gauze into the uterine cavity.

Acute endometritis is generally found in acute septic processes involving the entire genital tract, but on account of the predominating symptoms of the other organ, it is usually overlooked. Under any circumstances it is a rare affection.

The surface epithelial cells are swollen often to as much as two or three times their normal size, while the adjacent cells may be compressed. There is also a tendency to cell proliferation, and between the epithelial cells are many polymorpho-nuclear leucocytes and some small round cells. The glands in the superficial portions show similar changes, a swollen epithelium with some tendency toward proliferation, and a small round-celled and polymorpho-nuclear-celled infiltration; leucocytes are found partially filling some of the gland lumina. The deeper portions of the glands near the muscle are often normal.

The stroma shows superficially much infiltration, with polymorpho-nuclear leucocytes and small round cells, the infiltration diminishing toward the muscle. Alterations are rarely made out in the muscular tissue beneath.

Chronic endometritis is also rather rare. The prevailing habit of describing all scrapings, particularly because of their abundance in some cases, as examples of endometritis, is greatly to be deplored. It interferes with our getting any satisfactory idea as to the frequency of the real affection, and tends to encourage unnecessary operating. The so-called "fungoid endometritis" is not a pathological entity at all, and the name ought to be expunged from gynecological works.

Chronic endometritis is oftenest associated with old cases of pyosalpinx; it is rarely ever found in the ordinary scrapings. The slight liability of the uterine mucosa to this affection may be ascribed to two factors: In the first place, the tendency of pus-containing tubes is to complete closure at the uterine end, thus shutting off one avenue of infection, and, in the second place, the form and position of the uterine canal is such as to afford good drainage.

The surface of the mucosa may be rather uneven, and the epithelium stunted, low, cylindrical, or cuboidal. The glands are in places diminished in number, and vary much in size; some of them are narrow superficially and distended below. The epithelium of the dilated glands is somewhat flattened.

The stroma is denser than normal, especially in the superficial portions, its nuclei tend to become spindle-shaped, and there is much small round-cell infiltration. There are practically no polymorpho-nuclear leucocytes to be seen. The stroma in its deeper portions is often normal, and there are no changes in the muscle.

Decidual Endometritis.—This is always found after an abortion in the early months, and is often probably the cause of the abortion.

The decidua shows marked polymorpho-nuclear-celled infiltration, especially in its superficial portions; the leucocytes are so abundant that the individual decidual cells are separated from one another. Some small round cells usually accompany the infiltration. The deeper portions of the decidua are usually unaltered.

Mucous Polypi.—A mucous polyp is a localized outgrowth of the uterine mucosa, forming one or more small tumors within its cavity. The tumors do not often attain a size greater than 2 by 3 cm. They occur in a variety of forms, either finger-like, round and pedunculate, pear-shaped, or like a cock's comb with a broad base.

In one of my cases a flattened ovoid polyp 1.5 cm. long was found lying in the cervical canal, attached to the fundus by a thread-like pedicle 1 mm. in diameter and between 4 and 5 cm. long. The velvety appearance of a polyp, with its slight indentations, resembles that of the uterine mucosa; often small cysts, formed by distended glands, can be seen on the surface.

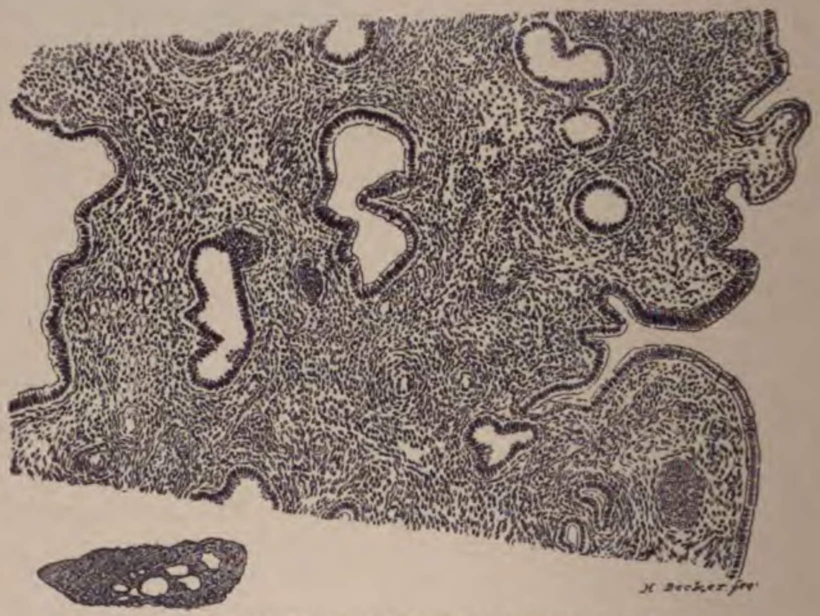


FIG. 326.—SECTION OF A GLANDULAR UTERINE POLYP.

The small figure below shows a section of the polyp magnified three times; the larger section above is magnified seventy times. The dilated glandular spaces are seen lying in the connective-tissue stroma. Specimen 682.

They sometimes give rise to protracted hemorrhages, but as a rule they produce no symptoms at all.

Histologically, the epithelium is the same in character as that lining the uterine cavity with which it is directly continuous.

The entire polyp is made up of uterine mucosa, epithelium, glands, and stroma. The glands are mostly normal, but where they are dilated and form small cysts, the epithelium becomes cuboidal and the cavities contain some desquamated epithelial cells. The stroma, especially near the tips, often shows hemorrhage and edema.

In sharp contrast to the usual, isolated mucous polyps just described is the rare, general excessive hypertrophy of the mucosa, of which a single instance has come under my notice (A. L., J. H. H., No. 3476, May 7, 1895).

The entire uterine mucosa was thickened to about three times the normal thickness, and appeared everywhere in the form of flattened dome-like elevations, separated from each other by shallow furrows 2 or 3 mm. in depth; the macroscopic appearance was strikingly like that of malignancy. Microscopically, the excessive growth was limited to the glands, which, although normal in number, were increased in size and markedly convoluted. The stroma was normal.

Remnants of Abortion.—In curetting to remove a dead ovum or an incomplete miscarriage, the chief danger lies in the readiness with which sepsis may invade the upper genital tract. In cases which are already septic, the avoidance of a general infection and the safety of the patient depend upon the complete removal of the ovum, and the establishment of efficient drainage through the dilated cervix. There is no way by which we can thoroughly disinfect a septic uterus. Cases which are not septic, will not become so if the operation is aseptically performed, and the aseptic conditions are maintained afterwards. When the flow does not begin to diminish within two days after an abortion, or when the temperature rises three or four degrees, I at once advise curettage. The cervix in these cases is usually soft, and dilatation more easily effected in consequence, and not infrequently the cervix is so open as to need no dilatation at all.

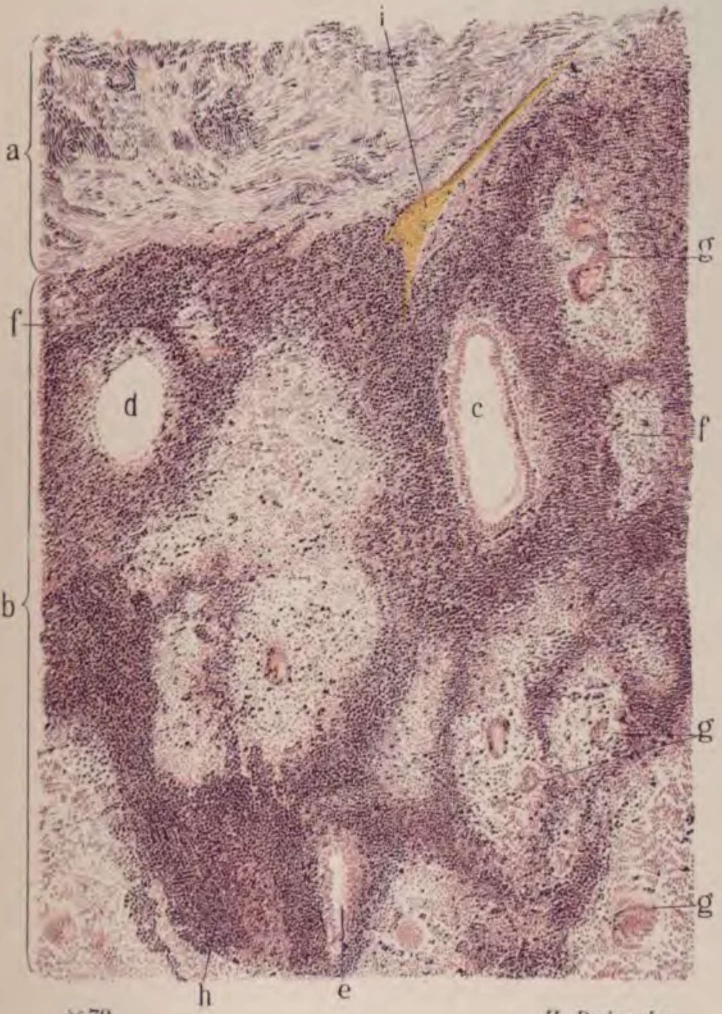
The anterior cervical lip is caught with tenaculum forceps, a blunt spoon curette introduced and used with gentle force over the whole inner surface of the uterus, loosening and bringing down the membranes which begin to pour out of the os. Undue force must not be used, lest the curette perforate the softened uterine wall and pass into the abdominal cavity, exposing the patient to the imminent risk of a septic peritonitis. After loosening the membranes with the curette, a pair of fenestrated placental forceps (see Fig. 85, page 144) is inserted, which brings away the placenta, decidua, and fetus, if not previously expelled, whole or in pieces.

When the canal is large enough, as is usually the case in a miscarriage after the third month of pregnancy, the index finger well sterilized should be introduced, and the whole interior of the womb palpated.

Unsuspected pieces of tissue will often be found clinging to it especially in the placental area. These can be freed by the palmar surface of the finger, assisted by the external hand acting through the abdominal walls, affording a point of resistance. The uterine wall thus bared in places feels almost as thin as paper, and must be gently handled. Where curetting is difficult and uncertain, the entire separation of the remains of the ovum may be thus

DESCRIPTION OF PLATE IV.

Tuberculosis of the endometrium. This is a typical picture of early tuberculosis of the endometrium. Above is the normal uterine muscle, on the left side is a dilated gland lined with flattened epithelium, while in the middle of the section and at the lower margin two practically normal glands are seen. Scattered throughout the stroma of the mucosa are typical tubercles, most of which show giant cells. The intervening stroma is the seat of marked small-celled infiltration. There are no caseous areas present.



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H. Becker, fec.

effected by the finger alone, assisted by the hand making counter-pressure through the abdominal walls.

The finger nails must never be used to scrape tissue off from the uterine walls, as such a practice would often introduce sepsis, and if the case was already septic, the operator would be sure to carry the infection away with him to inoculate other patients.

Irrigation of the uterus after curetting is not necessary, unless the contents are septic, when the cavity must be repeatedly washed out with a warm boric-acid solution introduced by means of a curved, glass, douche nozzle, using the blunt end of the nozzle over the uterine surface to aid in detaching clots and small particles of *débris*. The uterus may be drained for forty-eight hours by packing its cavity loosely with gauze, the ends of which are allowed to hang out of the cervix into the vagina; my own practice, however, is simply to place a loose gauze pack in the vagina, which is renewed every twenty-four hours.

Patients should be kept in bed after curetting for abortion for two weeks or longer, to allow involution of the uterus to take place; care of the patient is just as important at this time as in the puerperium after a normal labor.

Microscopic Examination for the Remnants of an Abortion.—In these cases we usually have the clinical history of a recent miscarriage, and the amount of material removed by curettage is often abundant. As a rule, there is no suggestion as to their source in the macroscopic appearance of the tissues; occasionally little villous threads can be seen.

Histologically, the appearance of glandular hypertrophy predominates; the glands are dilated, convoluted, and show little tit-like processes springing into their lumina; the epithelium is a little flattened and the stroma of the mucosa shows marked swelling of its cells in the superficial portion, forming typical decidual cells which persist for several weeks after the abortion.

These appearances are suggestive of pregnancy, but a positive diagnosis must rest upon the discovery of villi; in the early months these still show two layers of epithelial covering, the inner of which is made up of cuboidal cells; the outer, syncytial layer, appears as a ribbon of protoplasm with nuclei distributed through it; this outer layer sends out protoplasmic buds which form the new villi, and in the centers of these buds are found from five to forty nuclei, forming the so-called placental giant cells, because when cut across they present the appearance of a typical giant cell. The interior of a villus is composed of mucoid tissue rich in blood vessels.

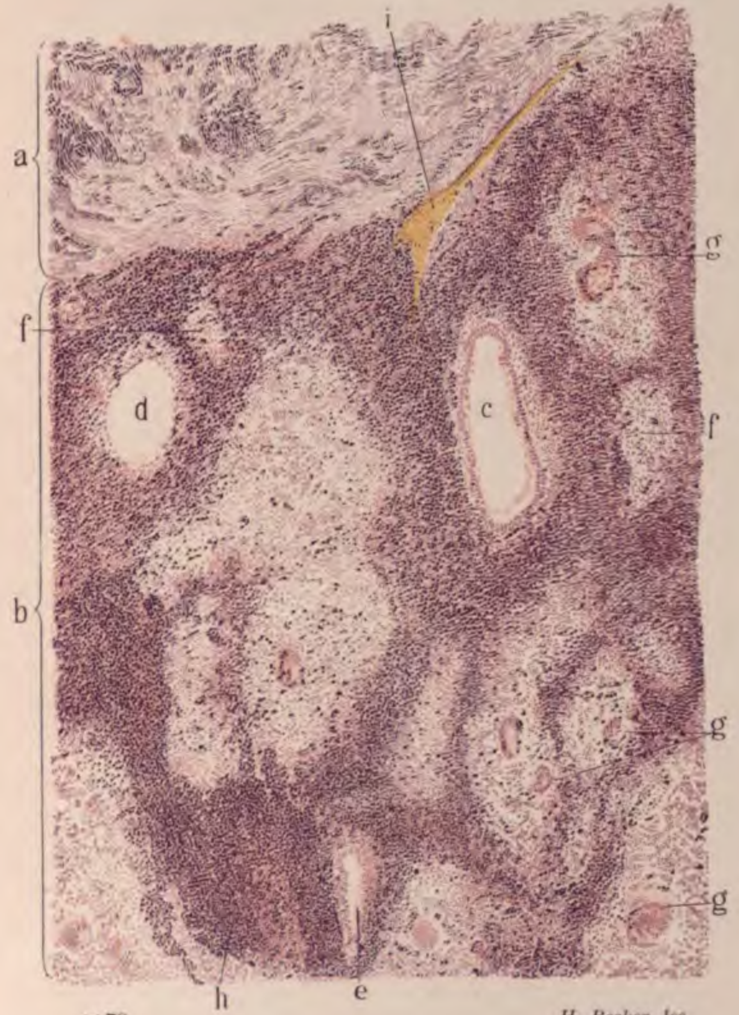
In one obscure case nothing was found in the curettings at first but some glandular hypertrophy, ill-defined decidual cells, and a single free giant cell; this latter structure led to a further searching investigation, which was rewarded by the discovery of villi, confirming the diagnosis of pregnancy.

Tuberculosis of the Endometrium.—In the early stages of this condition the epithelium of the surface is intact, the glands normal, and the tubercles are found scattered throughout the superficial portions of the stroma, consist-

DESCRIPTION OF PLATE IV.

Tuberculosis of the endometrium. This is a typical picture of early tuberculosis of the endometrium. Above is the normal uterine muscle, on the left side is a dilated gland lined with flattened epithelium, while in the middle of the section and at the lower margin two practically normal glands are seen. Scattered throughout the stroma of the mucosa are typical tubercles, most of which show giant cells. The intervening stroma is the seat of marked small-celled infiltration. There are no caseous areas present.

PLATE IV.



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H. Becker, fec.

ing of aggregations of epithelioid cells; later they are surrounded by small round cells, and at a still later date giant cells are found in the center.

The surface epithelium over a superficial nodule is often somewhat flattened and pale. In a marked case the glands are encroached upon, and it is at times almost impossible to distinguish some of the epithelioid cells from the gland epithelium; in other glands, tubercles are seen partly projecting into and obliterating the cavity; again the gland may be filled with caseous material.

In the most advanced cases where the cavity of the uterus is lined by caseous material, the surface is covered by a necrotic material devoid of nuclei, below which lies a zone of typical tubercular tissue, consisting of epithelioid cells and tubercles; in the deeper portions a stray gland may survive; where the process has gone deep enough to involve the muscle, the glands are often entirely absent.

Bacilli are found with varying frequency, sometimes sparse, sometimes abundant, and most numerous in the advanced cases with marked caseation; in my experience they are much more readily found than in tuberculosis of the tubes.

In the early stages of the disease the tubercular process may be entirely unsuspected, and the curettings may look like normal uterine mucosa; but where the disease is advanced, the presence of soft cheesy masses will at once arouse suspicion. Necrotic carcinomatous tissue may present a somewhat similar appearance, but the characteristic branching which is found here does not occur in tuberculosis. In advanced cases the diagnosis may also be reached from an examination of the uterine discharge which contains tubercle bacilli.

On histological examination, the diagnosis of tuberculosis is readily established, as the tissues present the usual tubercular picture. Dr. T. S. Cullen (*Johns Hopkins Hospital Reports*, vol. iv, p. 91) reports several cases of tuberculosis of the endometrium occurring in my wards.

It has happened several times in my experience that the tuberculosis has been found in a purely accidental way, as it were, while submitting the uterine scrapings to the routine examination. Again, I have found a tubercular endometrium on curetting the uterus immediately after removing tubercular tubes and ovaries.

Tubercular affections of the endometrium may be miliary, or part of a general tubercular process, or of the chronic diffuse form.

The chronic diffuse tuberculosis is that form with which we have to do; it begins, as a rule, near the fundus, secondary to a tubercular tube. The first visible alterations are little yellowish-white nodules under the surface, 1 to 2 mm. in diameter, which may increase in size and numbers, and then coalesce and break down, forming an ulcer with undermined edges. The disease extends from the endometrium down into the uterine muscle.

Cancer of the Body of the Uterus.—The curette is used in these cases for two purposes: First, to remove some of the lining membrane of the uterus for diagnosis, and, second, to remove as much of the diseased tissue as possible, so as to check hemorrhage and to clean out septic *débris*, in order to give the patient a chance to recruit before undertaking the total extirpation. In both instances the use of the curette is simply preparatory to hysterectomy.

The cancerous tissue breaks down readily under the curette, which must be used with unusual care and with gentler force than in endometritis, to avoid perforating the uterine wall in the more extensively infiltrated areas.

As a rule, the whole endometrium is affected, but where the disease is still localized, its position may be recognized by the distinct difference in the sense of touch, communicated through the instrument, between the diseased tissue as it breaks down, and the soft sound mucosa with its firm substratum of normal muscle.

Even the macroscopic appearance of the curettings in carcinoma of the body is quite characteristic, and much valuable information may be gleaned from a careful inspection; the normal uterine mucosa has a comparatively smooth surface and is usually from 1 to 2 mm. thick, but in carcinoma the surface, if still intact, has a branching or tree-like appearance. This may not at first sight be detected, as the mucus tends to glue the little projections together. Nearly all of these little stems or branches have delicate capillaries in their centers. One of the most striking points is the large amount of the tissue removed, together with the size of the individual pieces. Normally only a dram or slightly more can be removed; in carcinoma, however, from 4 to 8 drams may come away, and the individual pieces may reach 1 cm. or more in thickness and are very friable.

In curetting to check hemorrhage the whole endometrium should be scraped as rapidly as possible down to the firm muscular tissue, as by this means the hemorrhage is less than if the instrument is used slowly and timidly. The use of the curette under these circumstances is followed by a firm vaginal pack of iodoform gauze. Hemorrhage is caused in these cases by the superficial necrosis which opens up the vessels or permits them to rupture easily; it is therefore necessary to get well below this tissue, when the vessels cease to bleed by their normal contraction.

Cancer of the body of the uterus is found in two forms—epithelioma, made up of squamous epithelial cells, and adeno-carcinoma; not more than eight cases of the former have been observed.

Adeno-carcinoma of the Body of the Uterus.—As stated, abundant scrapings are usually furnished for examination—an amount never found normally.

These often have quite a characteristic appearance, even on a macroscopic examination; they appear as short, broken, irregular, friable bits of tissue, whitish and waxy in places, having little knob-like projections with coagula between them. Microscopically, the surface has usually disappeared, and the remaining tissue is made up of groups of small and large glands, varying much in appearance; some are lined by one layer of cylindrical epithelium, others by two or three layers, and still others are choked with cells. Large areas of epithelial cells are often found in which the glandular form has almost disappeared, due to an excessive overgrowth of the epithelium in which numerous glands are crowded together.

The stroma between the glands is composed of spindle cells, and shows much small round-celled infiltration.

It is not necessary, as commonly held, to demonstrate a penetration of the muscular layer by the glands in order to make the diagnosis of carcinoma. The diagnosis must rest upon the characteristic appearances above detailed as found in the mucosa alone, and this is fortunate, for the curette rarely penetrates as deep as the muscularis.

Sarcoma of the Uterus.—This rare disease is not often found in the uterine scrapings.

In my experience, the round, or the round and spindle-celled sarcomata have been found most commonly.

The macroscopic appearances are not characteristic, but microscopically large areas are found composed of round or of spindle cells, many of them containing nuclear figures and an increased amount of chromatin, as evidenced by the intense staining of the nucleus; there is also an absence of the uterine glands in these areas. Such a picture is strongly suggestive of sarcoma.

Where the superficial tissue is broken down and the muscularis is invaded by the characteristic cells the diagnosis is more certain.

I have operated in a single instance upon a case of sarcoma of the uterus in which the diagnosis had been made by curettage. No enlargement of the uterus could be detected bimanually, but, relying entirely upon the microscopic examination, I performed vaginal hysterectomy, and found a sarcomatous nodule 1 cm. (0.4 inch) in diameter in the left horn of the fundus projecting into the uterine cavity. The patient recovered, and lived for more than twelve years without any return of the disease. At the end of that time she died from another cause.

Carcinoma of the Cervix.—Curettage for cancer of the cervix is employed for two purposes: First, to remove the septic, breaking down cancerous material, and leave a clean field for hysterectomy; second, to remove as much of the disease as possible where it has advanced too far for complete extirpation.

Sometimes the uterus is more or less anchored at the vaginal vault by the extension of the disease into one or both broad ligaments. The amount of this infiltration can be better estimated by a rectal than by a vaginal examination. Such cases of cancer of the cervix, in which a broad, hard mass is detected on either side, extending out to the pelvic wall and interfering with the mobility of

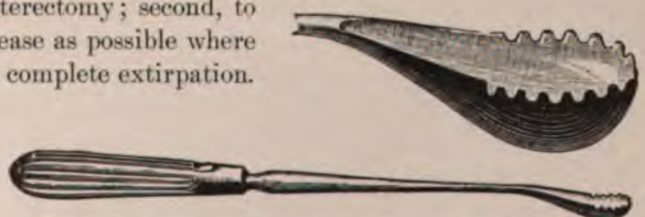


FIG. 327.—CURETTE FOR CARCINOMA OF THE CERVIX.

The serrations should be made much deeper than shown in the figure. Upper figure, natural size.

the uterus, are unsuitable for hysterectomy, and are best treated by thorough curettage. Even those advanced cases with marked cachexia and foul discharges, bedridden and suffering from nausea, will often be much benefited by thorough curettage, which removes the friable, sloughing masses, and leaves in their place a clean, cone-shaped excavation. I have found that the severe pain so often noted in these advanced cases is due to a choked cervix with retention of the discharges, forming a pyometra. Complete relief follows the evacuation of this fluid, if the canal is kept open.

The two most efficient forms of curettage are the fingers and a long scoop curette on a stout handle (see Fig. 327). The friable, redundant portions of the disease are best brought out by vigorously using the end of the index and middle fingers as a curette. It is astonishing how much of the affected tissue can be removed in this way. The scoop curette follows the fingers; held firmly and used boldly and rapidly it breaks down the diseased tissue under the guidance of the index finger, which locates the points to be curetted, and prevents the instrument from advancing too far in the direction of bladder, rectum, or peritoneal cavity.

The limit of the diseased tissue which can be removed in this way is recognized by the scraping sound and by sensation, indicating that a hard base has been reached. Less blood is lost by working rapidly down to the healthier tissue than by a slower procedure, which allows the rigid diseased vessels time to bleed.

When the disease has extended so far that the operator feels uncertain whether the next effort will invade bladder, rectum, or peritoneum, it is important to advance more slowly, controlling the curettage by repeated examinations. A finger in the rectum or a sound in the bladder will assist in determining the thickness of the septum. If the peritoneal cavity is accidentally opened, an iodoform gauze tampon should at once be closely packed within the rent and the operation continued until all septic and sloughing masses have been removed down to a clean wound surface. The vagina is now cleansed, the gauze removed, and a fresh pack inserted, projecting a short distance into the pelvic cavity; this is allowed to remain in place for three or four days, when it is removed and a fresh pack inserted, not quite so far up. The excavated area and the vagina must also be loosely filled with an iodoform gauze pack and protected by the vulvar occlusive dressing.

Two forms of cancerous disease are found in the cervix uteri—epithelioma and adeno-carcinoma.

To make a diagnosis in the early stages of carcinoma of the cervix, it is necessary for the clinician to send the pathologist a wedge of the suspicious portion, which should be at least 1 cm. in depth; this may readily be removed without pain after injecting a few minims of a 4 per cent solution of cocain deep into the cervical tissue, when two or three catgut sutures may be passed to close in the wound. Where the cervical disease is far advanced the ordinary curettings will be sufficient for the diagnosis.

Epithelioma.—The surface of the cervix is covered by several layers of squamous epithelium, which, however, can be seen penetrating the stroma in the form of finger-like or branching masses of cells; many of these branches when cut transversely or obliquely appear as round, oval, or irregular groups of cells lying deep in the stroma. On other parts of the surface of the tissue slight elevations are found which consist of a central blood vessel surrounded by little or no stroma and covered externally by numerous layers of squamous epithelium, indicative of an outgrowth of blood vessels and stroma with a disproportionate increase in the epithelial layers.

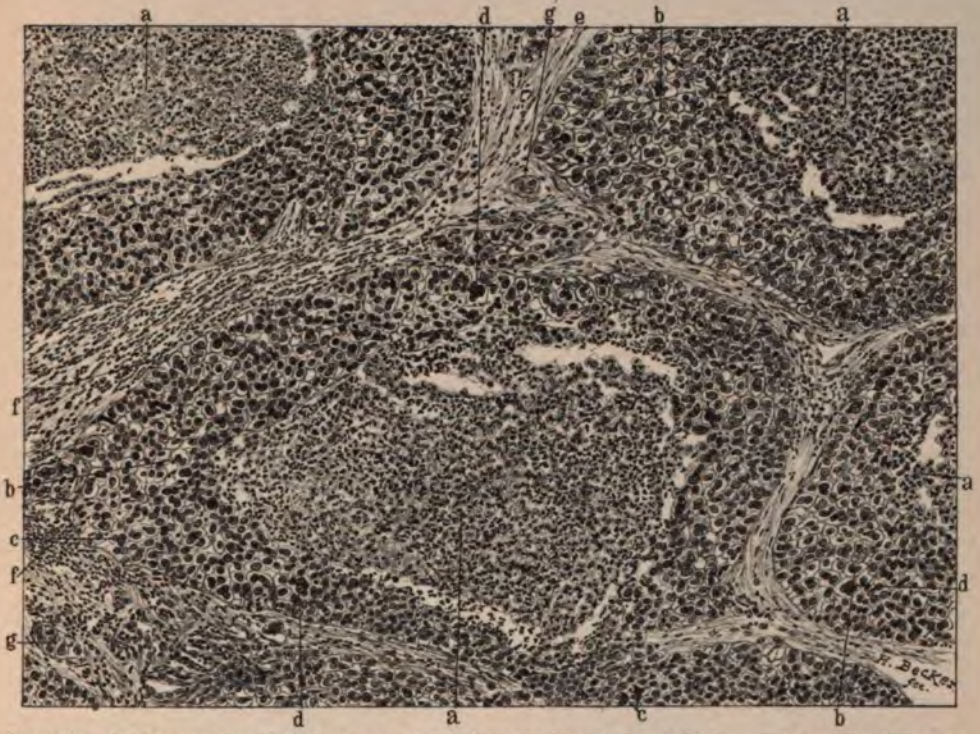


FIG. 328.—SQUAMOUS-CELLED CARCINOMA OF THE CERVIX SHOWING THE DEPRESSIONS ON THE SURFACE FILLED UP WITH PUS CELLS AND DETRITUS, *a*.

b indicates the typical cells; at *c* the nuclei are enlarged and stain deeply; at *d* giant cells are seen. The protoplasm is increased and the nuclei, four or five in number, are bunched in the center of the cells; *e* is the stroma and shows moderate small-celled infiltration as indicated by *f*; at *g* small isolated clusters of carcinomatous cells are present in the stroma. (T. S. Cullen, "Cancer of the Uterus," 1890.)

The cervical glands are usually normal, except that in some cases the squamous epithelium may be found projecting into the lumen of the gland and partly occluding it; in more advanced cases the glands are completely obliterated.

Such a macroscopic appearance affords conclusive evidence of the existence of epithelioma of the cervix.

Adeno-carcinoma.—The disease here first manifests itself inside of the cervical canal, where it is often invisible upon inspection and beyond the reach of touch, even when it has extended out as far as the broad ligament.

The examination by curettage reveals in most cases an absence of the surface epithelium. When the epithelium is intact, there is sometimes a marked proliferation of the cells in the form of tit-like outgrowths, which, developing in excess, form new glands.

The cervical glands are in some places normal, while in others there is an increase in the epithelium, and the gland, ordinarily lined by one layer, now shows two or three layers of epithelium. Other glands show tit-like epithelial excrescences projecting into their cavities which choke the lumen in the older portions of the disease. The glands appear to run riot in the tissue, interpenetrating the cervix in all directions.

DIGITAL EXPLORATION OF THE UTERINE CAVITY.

A valuable method of exploring the uterus in cases where there is persistent hemorrhage from a source which can not be determined by simple dilatation and curettage, is afforded by the following method. The cervix is exposed by means of a retractor and drawn well down to the vaginal outlet as shown in Fig. 329. A transverse incision about 2½ cm. above the os separates the anterior vaginal wall from the cervix and enables the operator, using blunt

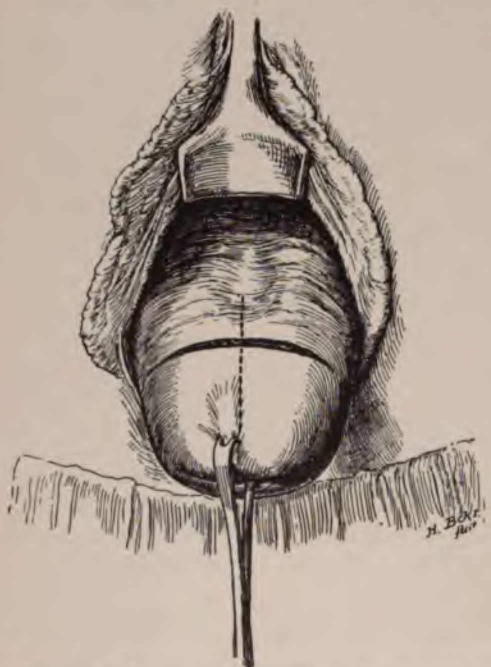


FIG. 329.—INCISION ANTERIOR TO CERVIX FOR DETACHMENT OF BLADDER.

The dotted line indicates the incision to be made in the uterus, as seen in the next figure.

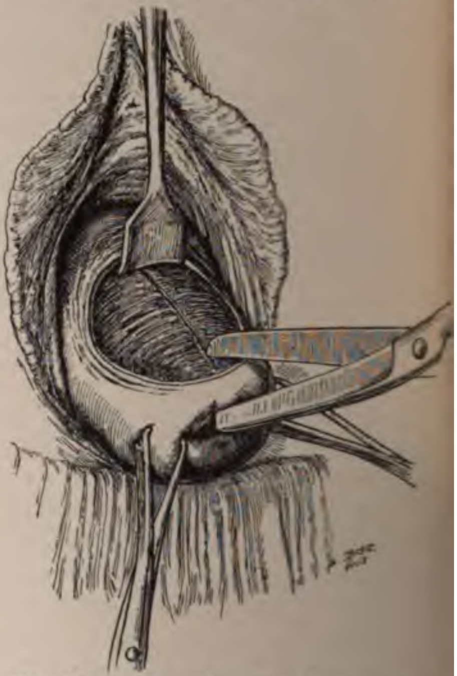


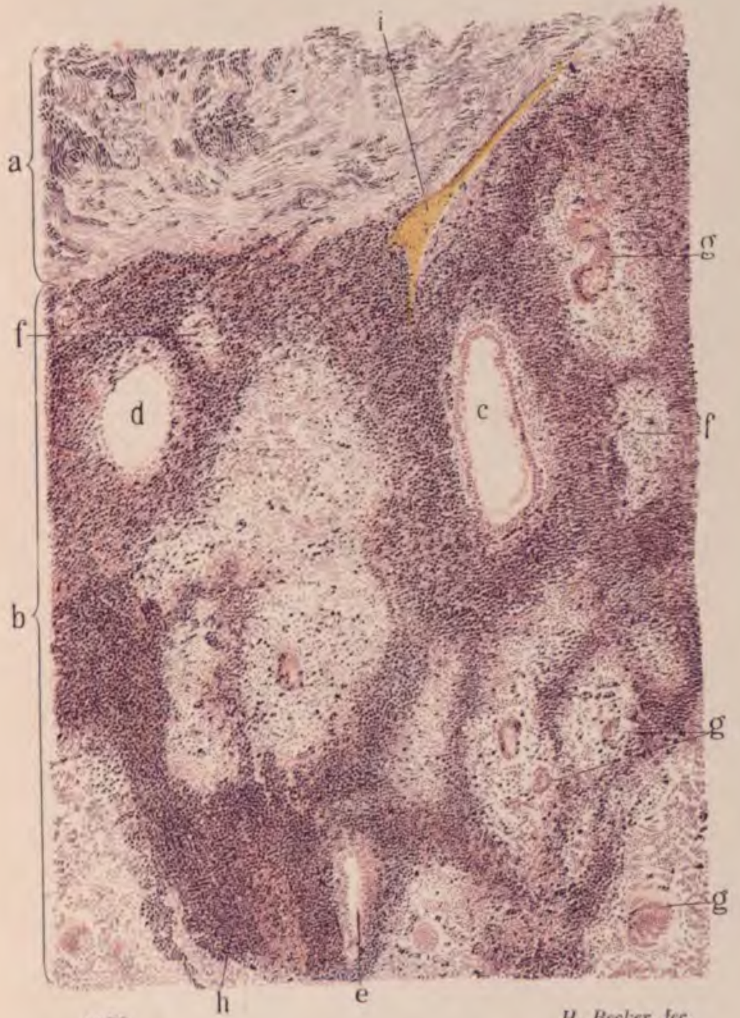
FIG. 330.—MAKING THE UTERINE INCISION IN THE ANTERIOR MEDIAN WALL.

PLATE V.

DESCRIPTION OF PLATE IV.

Tuberculosis of the endometrium. This is a typical picture of early tuberculosis of the endometrium. Above is the normal uterine muscle, on the left side is a dilated gland lined with flattened epithelium, while in the middle of the section and at the lower margin two practically normal glands are seen. Scattered throughout the stroma of the mucosa are typical tubercles, most of which show giant cells. The intervening stroma is the seat of marked small-celled infiltration. There are no caseous areas present.

PLATE IV.



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H. Becker, fec.

ing of aggregations of epithelioid cells; later they are surrounded by small round cells, and at a still later date giant cells are found in the center.

The surface epithelium over a superficial nodule is often somewhat flattened and pale. In a marked case the glands are encroached upon, and it is at times almost impossible to distinguish some of the epithelioid cells from the gland epithelium; in other glands, tubercles are seen partly projecting into and obliterating the cavity; again the gland may be filled with caseous material.

In the most advanced cases where the cavity of the uterus is lined by caseous material, the surface is covered by a necrotic material devoid of nuclei, below which lies a zone of typical tubercular tissue, consisting of epithelioid cells and tubercles; in the deeper portions a stray gland may survive; where the process has gone deep enough to involve the muscle, the glands are often entirely absent.

Bacilli are found with varying frequency, sometimes sparse, sometimes abundant, and most numerous in the advanced cases with marked caseation; in my experience they are much more readily found than in tuberculosis of the tubes.

In the early stages of the disease the tubercular process may be entirely unsuspected, and the curettings may look like normal uterine mucosa; but where the disease is advanced, the presence of soft cheesy masses will at once arouse suspicion. Necrotic carcinomatous tissue may present a somewhat similar appearance, but the characteristic branching which is found here does not occur in tuberculosis. In advanced cases the diagnosis may also be reached from an examination of the uterine discharge which contains tubercle bacilli.

On histological examination, the diagnosis of tuberculosis is readily established, as the tissues present the usual tubercular picture. Dr. T. S. Cullen (*Johns Hopkins Hospital Reports*, vol. iv, p. 91) reports several cases of tuberculosis of the endometrium occurring in my wards.

It has happened several times in my experience that the tuberculosis has been found in a purely accidental way, as it were, while submitting the uterine scrapings to the routine examination. Again, I have found a tubercular endometrium on curetting the uterus immediately after removing tubercular tubes and ovaries.

Tubercular affections of the endometrium may be miliary, or part of a general tubercular process, or of the chronic diffuse form.

The chronic diffuse tuberculosis is that form with which we have to do; it begins, as a rule, near the fundus, secondary to a tubercular tube. The first visible alterations are little yellowish-white nodules under the surface, 1 to 2 mm. in diameter, which may increase in size and numbers, and then coalesce and break down, forming an ulcer with undermined edges. The disease extends from the endometrium down into the uterine muscle.

Cancer of the Body of the Uterus.—The curette is used in these cases for two purposes: First, to remove some of the lining membrane of the uterus for diagnosis, and, second, to remove as much of the diseased tissue as possible, so as to check hemorrhage and to clean out septic *débris*, in order to give the

REPAIR OF THE LACERATED CERVIX.

Almost all cervices in parous women show distinct evidence of injuries, which take the form of single, bilateral, or stellate lacerations. These lacerations vary in extent all the way from a slight indentation to a deep rent, completely separating anterior and posterior lips, and extending far out into the vaginal vault.

The mere fact of the existence of a tear, however deep, by no means constitutes an indication for operation. I constantly receive patients who have been sent long distances for the surgical treatment of harmless injuries of this kind.

Cases suitable for operation are those only in which the lips are infiltrated, congested, and pouting, oftentimes with choked glands, pouring out a tenacious mucous secretion. A potent reason for operating upon these diseased cervices is the remarkable frequency with which they are found associated with cancer.

The patient, when possible, should be prepared for the operation by rest, hot vaginal douches once or twice daily, and by keeping the bowels regular. Every four or five days the physician should treat the cervix by puncturing any dilated follicles, and relieving the congestion by a scarification, drawing off from 15 to 30 c.c. (½ to 1 ounce) of blood each time.

To deplete the cervix I use an instrument with a short knife blade bent at right angles to the handle to prevent it from penetrating too deeply into the tissues. To do this the cervix is exposed with a speculum and caught with the tenaculum forceps, after which the knife-blade tenaculum is plunged rapidly and deeply into the congested extremity and vaginal surfaces, four or five times in either lip. I have never seen any alarming hemorrhage follow this treatment. Should the oozing at any point prove too persistent, it may be controlled by a suture. After each treatment a pledget of cotton is laid in the vagina saturated with boroglycerid, supported by a wool pack below, and left in place for twelve hours.

FIG. 333. — KNIFE-BLADE TENACULUM FOR DEPLETING THE CERVIX.

The blade, set at an angle on the shaft, is prevented from penetrating too deeply. ⅓ ordinary size.

With such preparatory treatment, carried out every five or six days, an infiltrated everted cervix, so rigid that the lips can not be drawn together, will soften sufficiently for operation in the course of two or three weeks.

There is a condition, commonly known by the erroneous title of erosion of the cervix, which must be carefully distinguished from laceration. The os forms a wide transverse slit, and the surfaces of both lips are covered with an angry, red, glistening, fissured surface, upon which a closer examination reveals the orifices of numerous glands. This is due to an infection of the cervical glands and a swelling of its mucosa, which, having no room inside, is compelled to roll out onto the vaginal surface; it is therefore an eversion of the cervical mucosa.

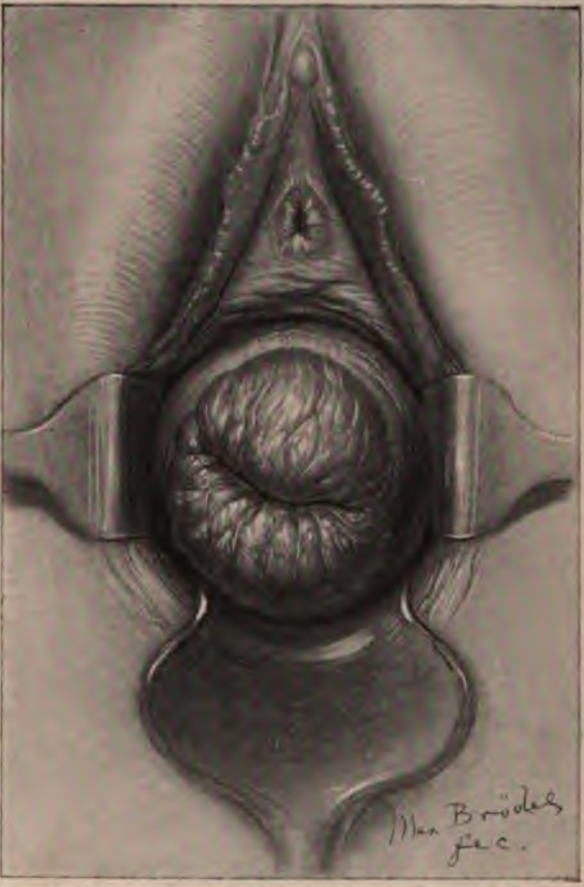

FIG. 334.—SO-CALLED "EROSION" OF THE CERVIX UTERI.

There is no laceration, but an infection of the cervical glands which has caused the mucosa to swell up and roll out into the vagina, partially everting the cervix. Age 20. Gyn. No. 4865. DEC. 12, 1896.

Operation.—The plastic operation for the repair of a lacerated cervix was devised by Dr. T. A. Emmet ("Principles and Practice of Gynecology," Philadelphia, 1884, p. 466).

The posterior vaginal wall is retracted by a Sims or Simon speculum, the cervix exposed, and its anterior and posterior lips each caught in the center by a pair of tenaculum forceps and drawn toward the vaginal outlet. Retractors on both sides hold back the lateral walls and expose the angles of the tear.

There are two steps in the operation: First, the denudation of the lips; second, the approximation by suture.

Denudation.—The accumulation of scar tissue in the angles of the rent between the lips must always be removed; serious disturbances have arisen from forcibly uniting the lips over such a rigid fibrous plug. To make sure of this, I commence the denudation by an incision into one of the angles entirely through the scar until the sound tissue below is reached. This limits the depth of the denudation in the angles of the tear. I next outline the area of denudation with a sharp knife, by deep incisions on both anterior and posterior lips.

The outline extends from each end of the incision in the angle out to the end of the lips. If the tear is bilateral a similar incision is made in the angle of the opposite side, and the area to be removed is similarly outlined on the lips of that side. A strip of mucosa $\frac{1}{2}$ cm. wide must be left between the lines of incision for the cervical canal. The outlined area is now denuded by catching the tongue of tissue between the incisions with rat-toothed forceps and removing it completely with knife or scissors. A serious and not uncommon error is to denude by shaving off the surface of the cervix on its vaginal side. The lips of a cervix so held together present a good external appearance, but a sound introduced within the canal demonstrates at once that the apparently normal cervix is but a pouch,

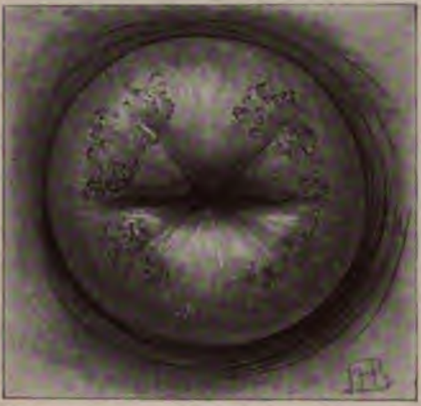

FIG. 335.—BILATERAL LACERATION OF THE CERVIX, WITH PUFFY, INFILTRATED LIPS.

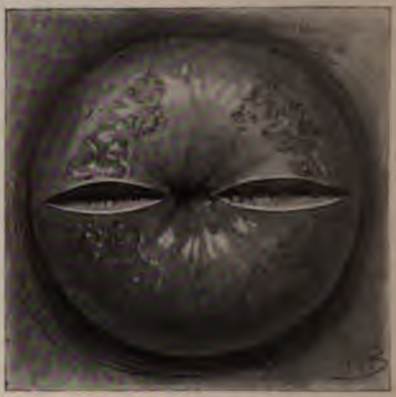

FIG. 336.—INCISIONS INTO THE ANGLES OF THE LACERATION EXTENDING DOWN THROUGH THE SCAR TISSUE.

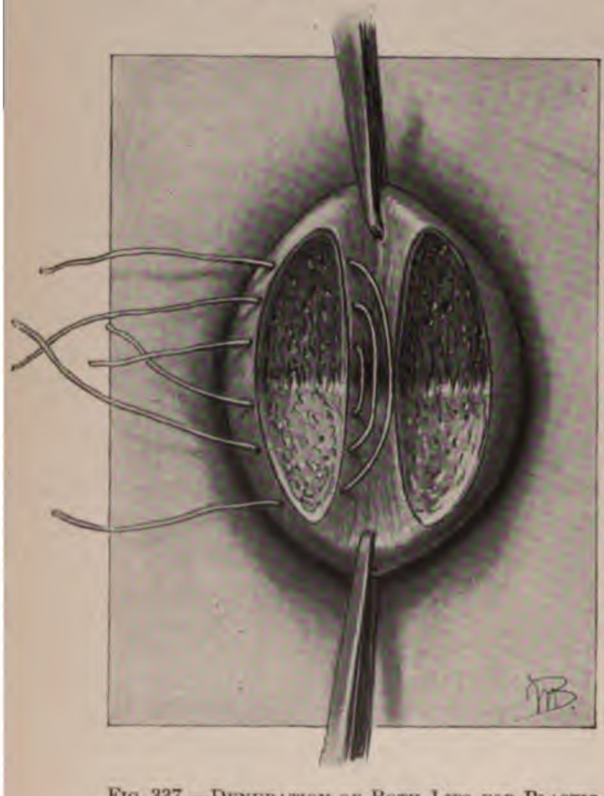

FIG. 337.—DENUDATION OF BOTH LIPS FOR PLASTIC UNION. THE SUTURES LAID IN PLACE ON THE RIGHT SIDE BUT NOT TIED.

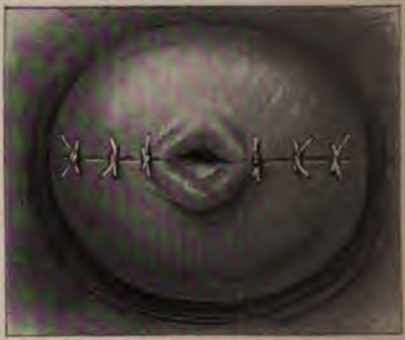

FIG. 338.—THE CERVIX AFTER ALL THE SUTURES ARE TIED ON BOTH SIDES.

with a thin septum of vaginal tissue on each side, and the cervical tear is no more repaired than it would be if a suture were simply passed through the ends of both lips, drawn up and tied.

The fear of wounding a circular artery in denuding the cervix is groundless. Any vessel which may be cut will readily be controlled by bringing the lips firmly together.

Sutures.—The proper sutures are silkworm gut or catgut. The sutures are introduced by means of a stout medium-sized needle and a carrier. As a rule, two or three silkworm gut sutures on each side are enough; fine superficial catgut sutures are used between them for accurate union.

The first silkworm gut suture is introduced up at the angle, entering upon the vaginal surface, coming out on the uterine surface of one lip, reëntering on the uterine surface, and coming out at the corresponding point of the opposite lip. All the sutures are best introduced first on both sides, and then tied successively from above downward. In case the vaginal outlet is operated upon at the same time, the assistant will find it easier to locate the loop for removal of the sutures if they are clamped with perforated shot instead of being tied. Fine superficial catgut sutures are used to secure accurate approximation between the silkworm gut sutures. All the silkworm gut sutures are now cut about $2\frac{1}{2}$ cm. (1 inch) long, to facilitate their removal later.

A loose gauze pack is placed in the vagina to absorb the discharges for the first two or three days, after which it is removed and the outlet simply protected by boric acid powder and a vulvar pad. If there is any discharge after this the vagina may be douched out daily with a weak solution of menthol, soda, and borax. It will not, as a rule, be necessary to catheterize.

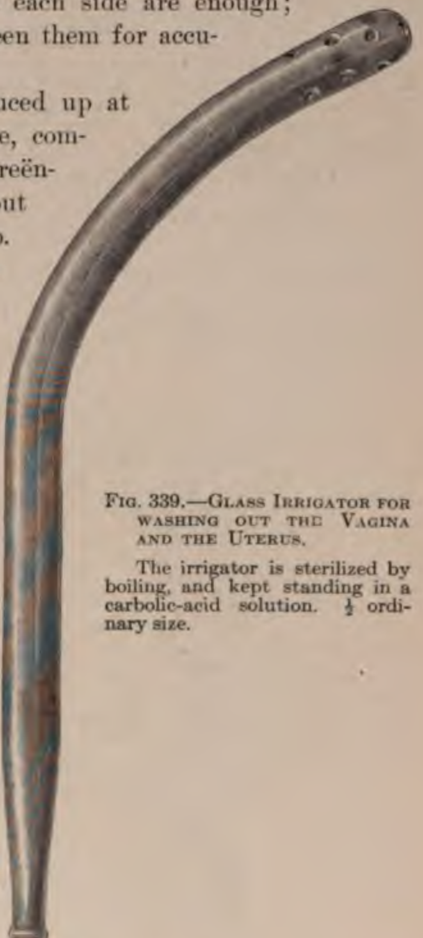

FIG. 339.—GLASS IRRIGATOR FOR WASHING OUT THE VAGINA AND THE UTERUS.

The irrigator is sterilized by boiling, and kept standing in a carbolic-acid solution. $\frac{1}{2}$ ordinary size.

Where no operation has been performed at the vaginal outlet, the cervical sutures may be removed in ten days or two weeks. When the outlet has been repaired, the servical sutures should not be touched for four weeks or longer. The sutures are most readily exposed and removed with the patient in the knee-chest, or in the left lateral posture.

CHAPTER XXI.

VAGINAL HYSTERECTOMY.

1. Indication for vaginal hysterectomy (p. 602).
2. Preparation of the patient (p. 603): *a.* Preliminary curetting.
3. Operation (p. 604): *a.* Traction ligatures. *b.* Collaring cervix. *c.* Tying off one broad ligament. *d.* Delivery of uterus. *e.* Tying off the other broad ligament. *f.* Thorough inspection of field. *g.* Dressing.
4. After treatment (p. 613): *a.* Changing pack. *b.* Removing ligatures.
5. Accidents and complications (p. 615): *a.* Hemorrhage. *b.* Ligation of ureter. *c.* Rupture of bladder. *d.* Injury to the small intestine. *e.* Pelvic abscess. *f.* Ovarian tumor. *g.* Incomplete enucleation of the disease.

Indication for Vaginal Hysterectomy.—The removal of the entire uterus by the vagina through the inferior pelvic strait has been the operation most frequently performed in the past for cancer of the cervix, or of the cervix and fundus together, or of the fundus alone.

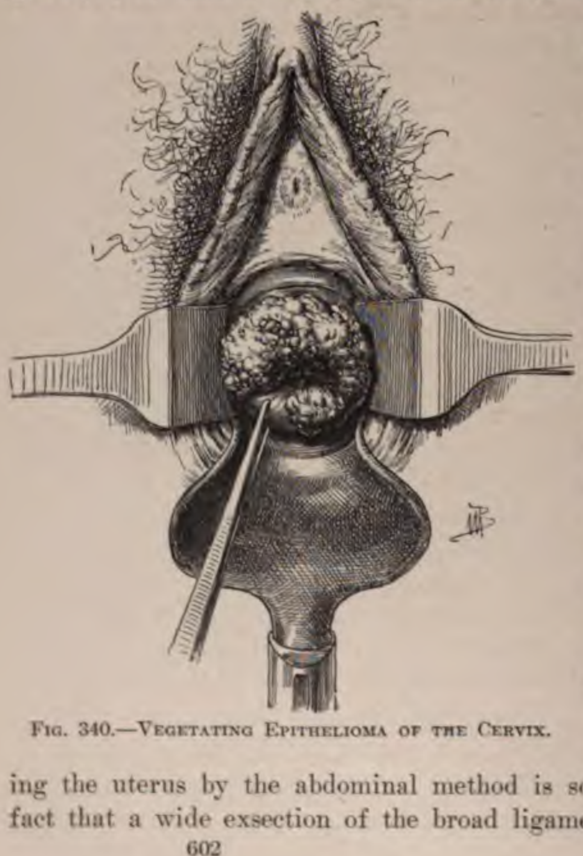

FIG. 340.—VEGETATING EPITHELIOMA OF THE CERVIX.

For the last three years my own practice has been to limit the indications for vaginal hysterectomy, choosing in preference the more radical enucleation through the abdomen, for by the vagina only the uterus and little or none of the adjacent broad ligaments can be removed, and so carcinomatous tissue is often left behind which might have been removed by a more careful dissection from above.

Vaginal hysterectomy is still indicated in fat women, whose thick abdominal walls form an almost insuperable obstacle to a complete operation from above. It is not because the difficulty in removing the uterus by the abdominal method is so great in these cases, but the fact that a wide exsection of the broad ligaments and removal of the pelvic glands is almost impossible, on account of the mechanical hindrances offered by the thick walls and the deep pelvis.

Preparation of the Patient.—The patient must be duly prepared by rest, baths, vaginal douches, and above all by a thorough evacuation of the bowels.

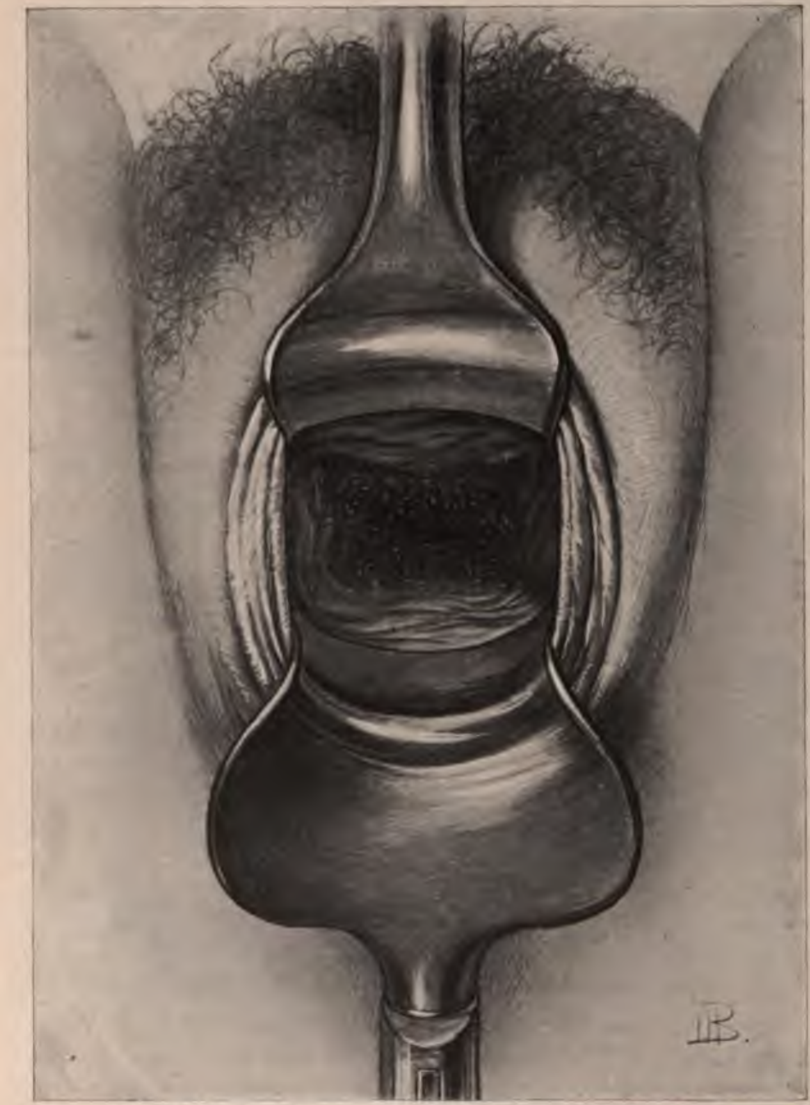

Fig. 341.—Epithelioma of the Cervix without Vegetation.

The vaginal vault is converted into a flat granulating surface. The cervical opening is seen in the center.

If the cancerous disease has advanced to the sloughing stage, or so far as to cause any odorous discharges, or to form a mass protruding into the upper vagina, the danger of sepsis will be greatly increased unless the field is first cleansed by a thorough curettage, removing as much of the diseased tissue as can be scraped away with a sharp curette (see Chap. XX). If the vagina is packed every two days after doing this, in a week or ten days the patient will be ready for the radical operation. In an urgent case the curettage may be done just before the uterus is removed.

Operation.—The patient is brought to the edge of the table in the lithotomy position, with the limbs well flexed and the buttocks resting on the perineal pad. The assistant then shaves the external genitals washing them well, together with the vagina, and curettes away all redundant cancerous masses with fingers and scoop, unless this has been already done.

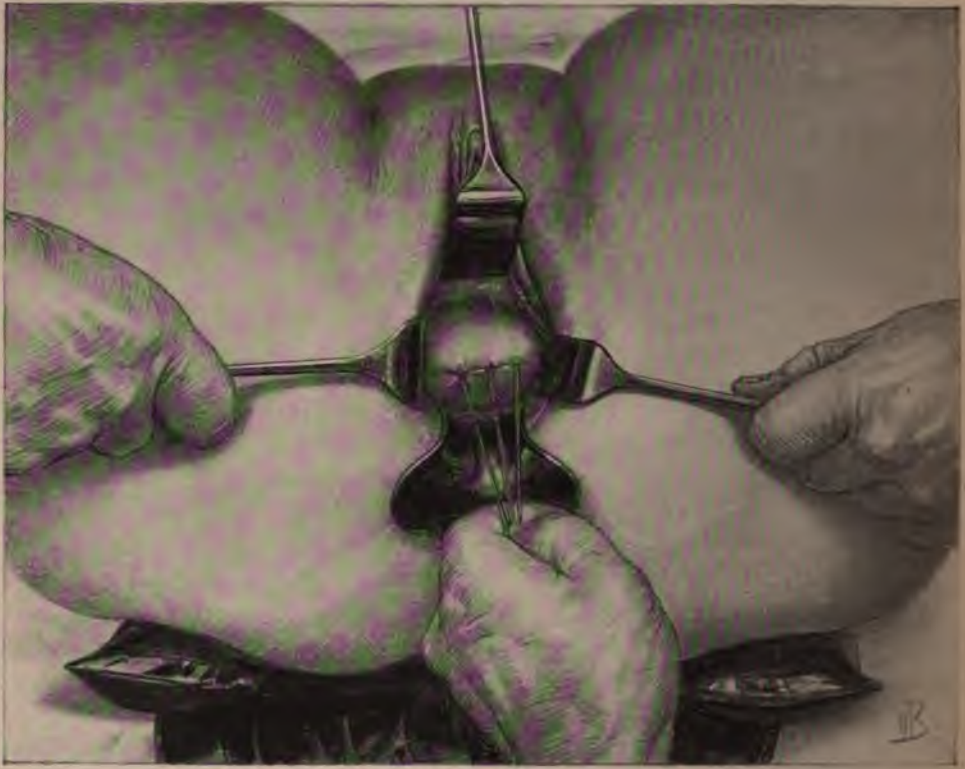

FIG. 342.—VAGINAL HYSTERECTOMY FOR CANCER OF THE UTERUS.

The uterus and cervix curetted thoroughly and the cervix sewed up with stout silk sutures left long for traction. The field of operation exposed by retractors.

The posterior vaginal wall is then retracted with a large Sims or Simon speculum, exposing the vault of the vagina and the cervix. If the vaginal outlet is narrow, hindering a view of the cervix, a greater degree of dilatation may be secured by boring in the hand with the tips of the fingers held together, making a conical dilator, or, better still, by using a conical rectal dilator, 6 cm. in diameter at the base. If the rigidity can nót be overcome in this way, one or two deep lateral incisions through the posterior commissure and extending around one or both sides of the rectum and up into the vaginal sulci, will give the necessary enlargement. The hemorrhage from the surfaces thus incised is rarely great enough to call for the use of forceps or ligatures.

Continuous irrigation is used to keep the field clear of blood during the first part of the operation, until the peritoneum is opened.

The vault of the vagina and the cervix being exposed as described, the anterior lip of the cervix is caught by tenaculum forceps and drawn down; the posterior lip is also caught, and a stout needle is passed through the anterior and posterior lips, carrying a heavy silk suture about 40 cm. (16 inches) long. Three or four of these ligatures are passed, and each one tied tightly, drawing the lips firmly together and completely closing the cervical canal and covering in the diseased area, to prevent the escape of any of the intra-uterine contents over the wound area during the enucleation. The ligatures are left long to serve as tractors, and enable the operator to hold the uterus down near the outlet, and to keep pulling it farther and farther down, delivering it gradually as its attachments are severed (see Fig. 342).

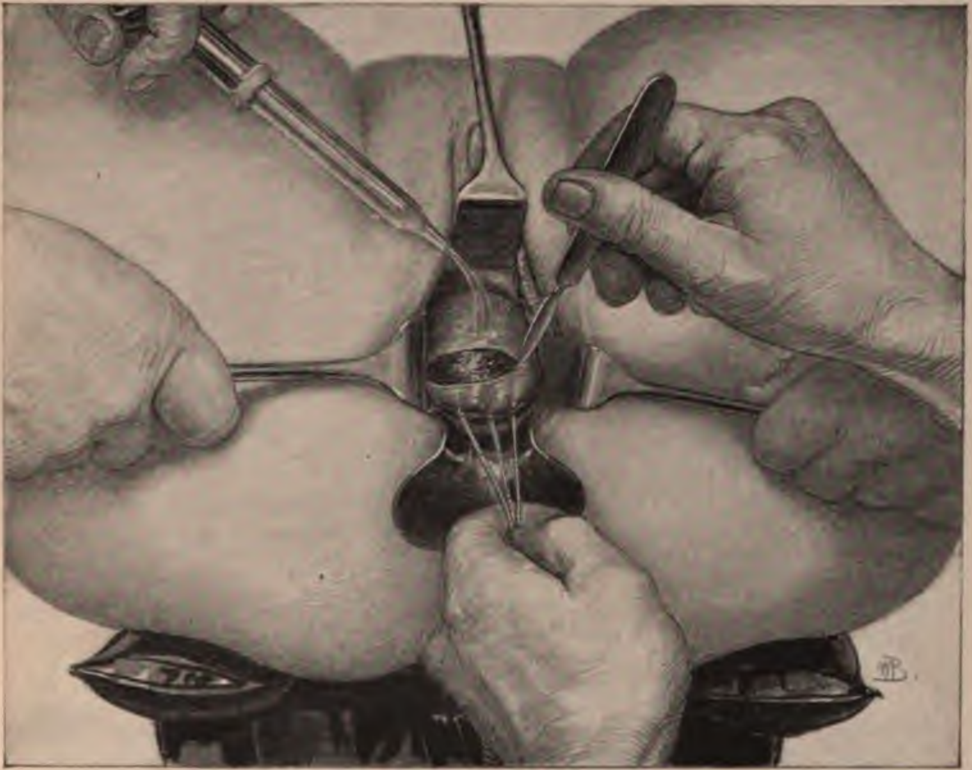

FIG. 343.—VAGINAL HYSTERECTOMY.

Beginning the operation by cutting the cervix loose from the vaginal vault, under continuous irrigation.

The cervix is first drawn down toward the vaginal outlet as far as it will come, often outside, and an assistant on either side holds back the lateral vaginal walls with a retractor so as to prevent them from hiding the field of operation. The operator, pulling on the traction ligatures, now makes a circular incision around the cervix and through the entire thickness of the vaginal vault, not less than 2 cm. ($\frac{3}{4}$ inch) distant from the margin of the disease (see Fig. 343). The Paquelin or galvano-cautery may be employed in this stage of the operation, instead of a knife, to check the oozing. Moderate bleeding from its margins may be disregarded until the close of the operation. More profuse bleeding should be controlled at once by ligatures passed through the vaginal walls, so as to grasp the vessels.

The knife or scissors are now laid aside, and the operator begins to push up and peel back the cellular tissue from its cervical attachments in front and behind the cervix with index and middle fingers (see Fig. 344). There is usually no resistance and rarely any serious hemorrhage, for the important blood vessels lie in the broad ligaments at the sides. Care must be taken in pushing back the tissues and freeing the cervix to keep the ball of the finger always directed toward the cervix. If the separation is carelessly performed

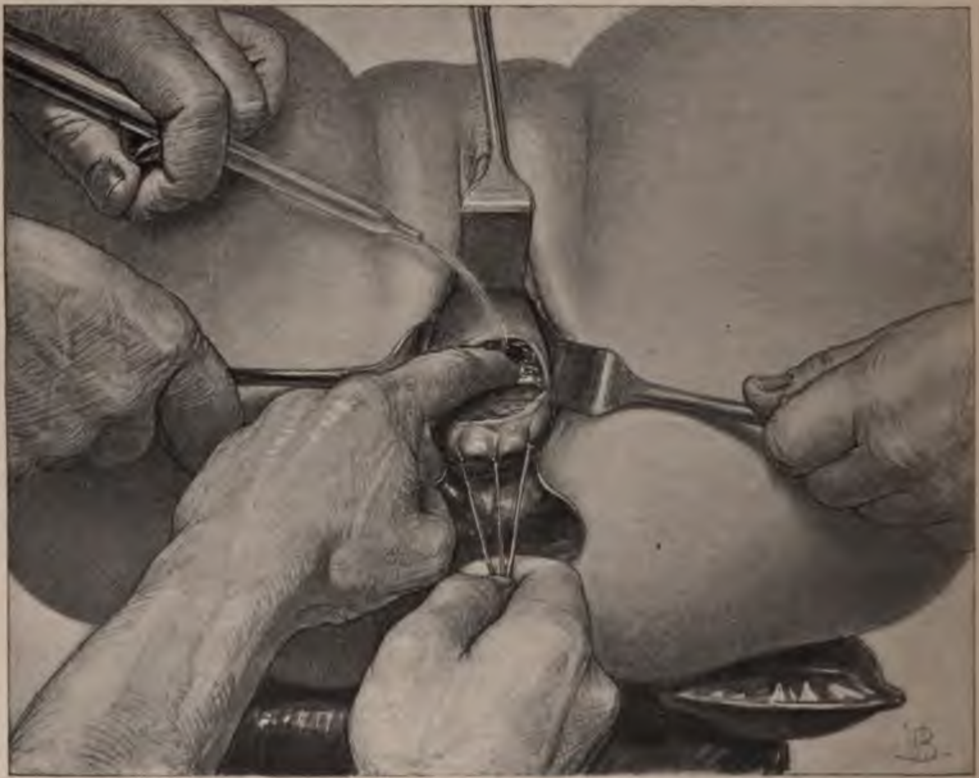

FIG. 344.—VAGINAL HYSTERECTOMY.
The finger is engaged in pushing up the bladder, detaching it from the cervix.

and this precaution neglected, there is danger of perforating the bladder or unexpectedly entering the peritoneum, especially if the disease has extended in either of these directions. As soon as peritoneum behind the uterus is reached, the fact is readily recognized by the fluctuation of a little fluid in Douglas' *cul-de-sac*, or by the smooth anterior and posterior surfaces gliding over each other. It is opened by catching a fold of it with forceps and making a small cut into it with scissors; one index finger is then thrust in, enlarging the opening, and then the other index finger is introduced, tearing the incision as wide as possible from side to side, well out to the bases of the broad ligaments.

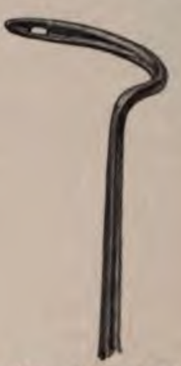

FIG. 345.—ANEURISMAL NEEDLE, WITH LEFT CURVE FOR PASSING LIGATURES THROUGH THE BROAD LIGAMENTS IN VAGINAL HYSTERECTOMY.

As soon as the peritoneum is laid open the irrigation must cease. A sterilized sponge, or pledget of gauze with string attached, is now pushed into Douglas' *cul-de-sac* to prevent the entrance of fluids or the escape of *débris* from the field of operation up into the peritoneum. A pair of artery forceps, clamped at the end of the string, distinguishes it at once from the ligatures applied to the broad ligaments.

The anterior vesico-uterine fold of peritoneum is next reached in like manner after completely detaching the bladder from its uterine connections. It is also recognized by the gliding of its peritoneal surfaces over each other. An opening is made by pushing in a pair of sharp-pointed scissors under the guidance of the index finger, spreading the handles and withdrawing them. The index fingers are then introduced as just described and the hole enlarged out to the broad ligaments on either side. This leaves the uterus hanging in the pelvis attached by the broad ligaments alone.

The anterior peritoneal fold may sometimes be more readily reached after the lower parts of the broad ligaments have been ligated and severed from the cervix, permitting a greater downward displacement of the uterus, and making this part of the peritoneum more accessible.

The accident of pushing the finger through the bladder will be avoided by frequently introducing a sound into the bladder as the operation progresses, to determine its exact position, and the thickness of the intervening wall. An accidental rent in the bladder at once shows itself by a sudden gush of urine into the vagina. This is most apt to occur when the disease has progressed through the cervix into the bladder wall. A fistula made in this way should be closed, after paring the edges to remove the disease, with interrupted silk sutures, when the enucleation of the uterus is completed. If this operation is performed immediately, it is rarely unsuccessful.

The next step in the enucleation is to tie off the broad ligaments with stout silk ligatures, introduced by a strongly curved blunt aneurismal needle (see Fig. 345). In introducing the first ligature—say on the right side—the cervix is drawn strongly to the left, and the right vaginal wall held out of the way by a retractor. The left index finger is placed beside the cervix, behind the broad ligament, and the aneurismal needle, armed with a ligature, is passed through, from before backward, on to the tip of the finger (see Fig. 346). This ligature includes a bunch of tissue about 1 cm. in diameter, and is entered about 1 cm. distant from the cervix, out toward the pelvic wall. The loop of the ligature is caught with a stout, blunt tenaculum, pulled out, and the needle is withdrawn (see Fig. 347). The ligature is tied at once, as tightly as possible, and drawn aside, after which the broad ligament is divided between the ligature and uterus, nearer the latter (see Figs. 348 and 349). All cutting is done with scissors, carefully snipping the tissues of the broad ligaments as they are drawn forward on the index finger. As soon as a little oozing of blood is seen to follow a cut, it means that an area of tissue is uncontrolled and another ligature must be inserted in a similar manner just

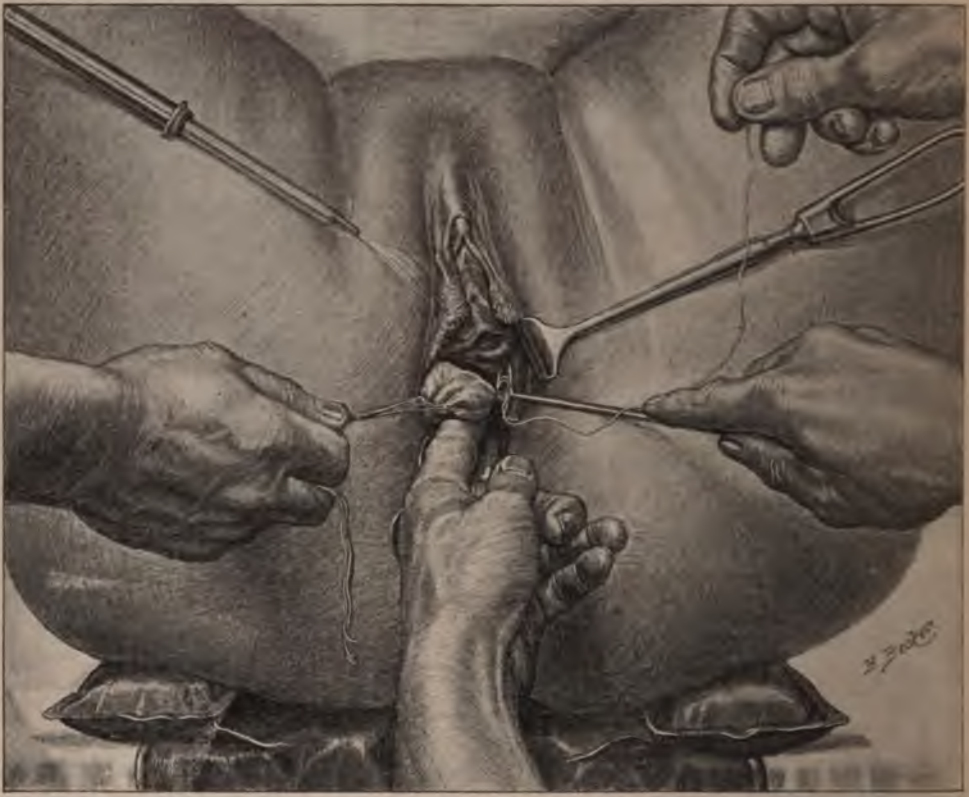

FIG. 346.—VAGINAL HYSTERECTOMY.

After freeing the bladder in front and opening the *cul-de-sac* behind, the base of the left broad ligament is exposed by pulling the cervix to the right, and tied off by passing a stout silk ligature in an aneurism needle.

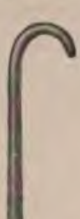

FIG. 347.—THE END OF THE STOUT BLUNT TENACULUM USED FOR CATCHING THE LIGATURE AND DRAWING IT DOWN IN VAGINAL HYSTERECTOMY.

above the last. The assistant must use the retractor with care, so as not to pull on the ligatures already tied. After introducing two or three ligatures in this way, one above the other, the cervix is drawn to the opposite wall, and the base of the left broad ligament ligated and severed in like manner.

An extensively infiltrated cervix occupies a considerable space in the narrow pelvis, and in consequence lies in close contact with the ureters. In such cases, as advised by Pawlik, a bougie or a catheter should be placed in each ureter before the operation. The exact position of the ureter is thus constantly evident to the fingers throughout the enucleation, and injury to the organ is avoided with ease and certainty. I have in this way several times avoided this accident. In one patient, after removing a large cancerous uterus, I found a separate mass in the left broad ligament, which I proceeded to enucleate with

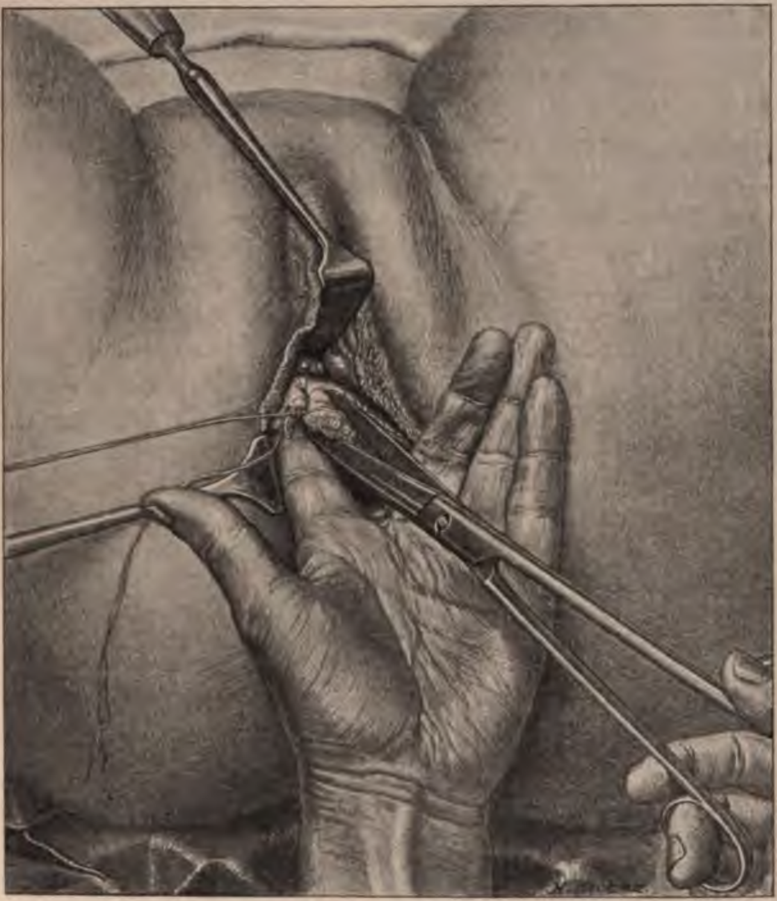

FIG. 348.—VAGINAL HYSTERECTOMY.

Freeing the right broad ligament from the uterus. The cervix lies to the left; the first ligature to the base of the broad ligament has been tied and hangs loose; the second ligature, including the uterine artery, has been tied just above the first, as shown, and the scissors are just about to divide the broad ligament between the ligature and the right border of the uterus.

forceps and scissors, actually dissecting it off from the ureter, which was bared for 7.5 cm. (3 inches), without injury, it being plainly defined the whole time by a bougie 2.5 mm. (0.1 inch) in diameter.

Moderate traction may be made upon the ligature when tied, assisting in exposing the area to be divided by the scissors; but as soon as the division is effected all traction must cease at once, lest the ligatures be pulled off. The uterine artery should be included in the second or third ligature applied. As soon as the peritoneum is opened the index finger will find the artery pulsating beside the cervix near the internal os. Its exact position once fixed serves as a guide in estimating the amount of tissue to be included in the ligatures in order to catch it in the second or third. The artery, when laid bare, is easily distinguished as a large, white, tortuous trunk with a lumen 2 or 3 mm. in diameter, strongly pulsating on its proximal side. As soon as the uterine arteries of one side are secured and severed from the uterus the operator continues to tie off the remainder of the broad ligaments on that side up to the top. When near

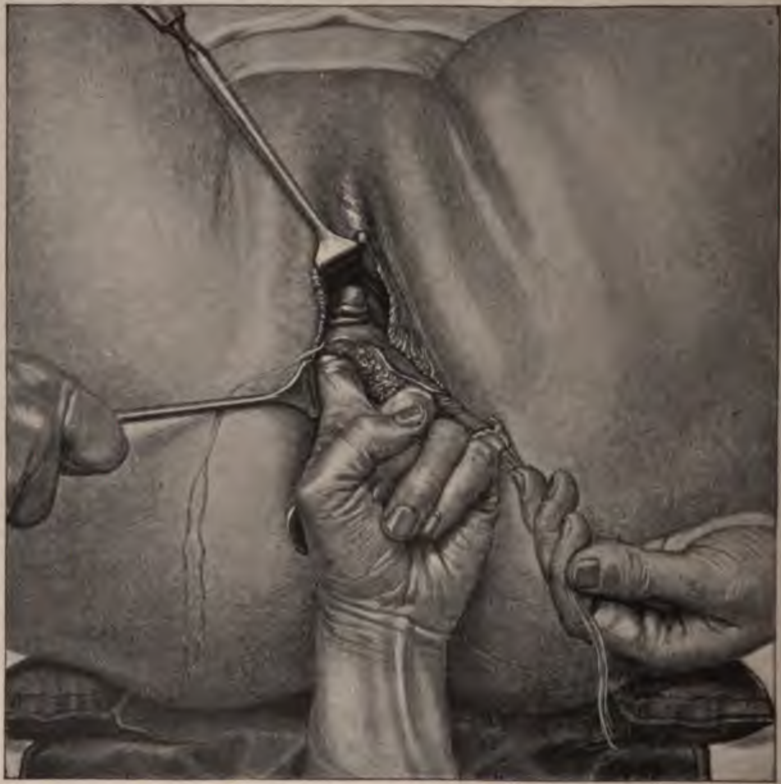

FIG. 349.—VAGINAL HYSTERECTOMY.

The cervix and uterus pulled well over to the left. The right broad ligament has been tied all the way up to the top, which will be tied next. The index finger is hooked behind the top of the broad ligament, pulling it down into view for the application of the last ligature. The round ligament and the tube are seen at their uterine ends.

the top of the broad ligament the finger is passed over the tube close to the uterine cornu, which is hooked down into view and tied.

If the cancer affects the body of the uterus, or there is a pyosalpinx or other pelvic inflammatory disease complicating it, the ligatures should be placed on the outer pelvic side of the ovaries and tubes which are removed together with the uterus. It is more difficult to complete the operation in this way with the removal of the ovaries and tubes, because the ligatures placed nearer to the pelvic wall are not so easily tied, and are more apt to slip off. The ligature at the top of the broad ligament must be tied with especial care, and the tissue cut at a distance from it, to avoid the risk of its slipping off. As soon as the whole of the right side of the uterus is freed, two fingers are inserted, the fundus caught from behind, and the body of the uterus slowly and carefully delivered sidewise through the opening in the vaginal vault, down through vagina and out into the vulvar cleft, where it hangs attached by the upper part of the left broad ligament (see Fig. 350). The enucleation is now completed by tying off the opposite side from above downward with two or more ligatures.

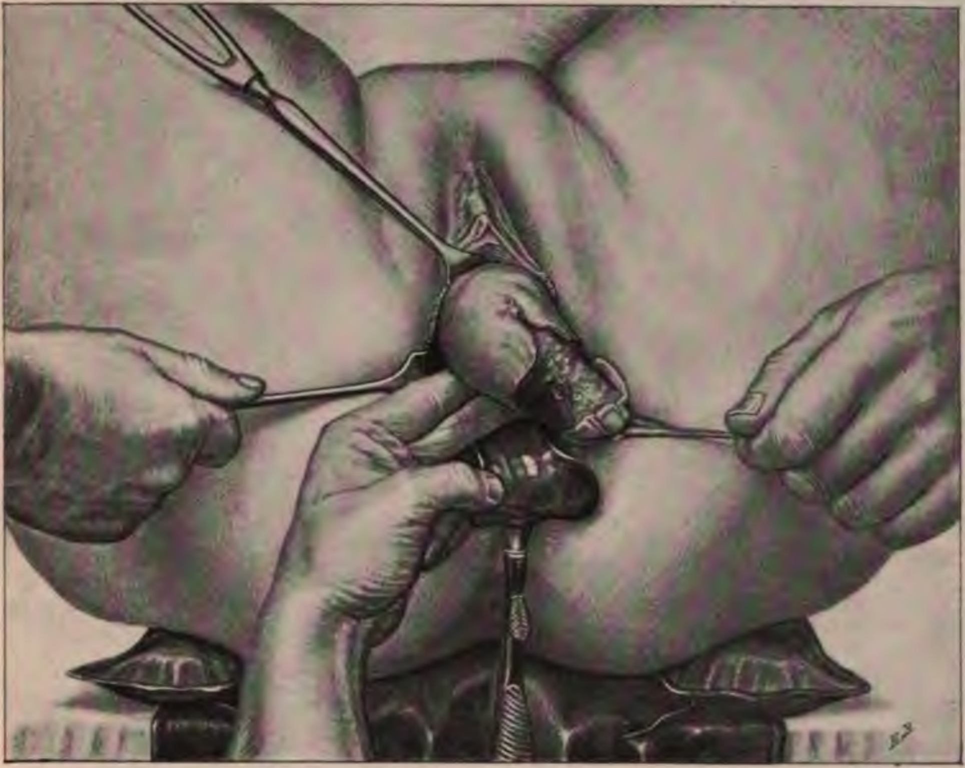

FIG. 350.—VAGINAL HYSTERECTOMY.

The uterus entirely freed on the right side and brought out onto the vulva. The remainder of the left broad ligament is now tied from above downward.

It is possible by removing the uterus in this way, from above downward, to apply the ligatures at a safe distance from the side which is more diseased; for this reason, in cases of advanced disease, it is best not to apply more than a single ligature below on the worse side.

As soon as the uterus is removed, the operator takes the sponge from the pelvis and separates the ligatures into right and left groups, holding them without traction, while an assistant pours a hot sterilized normal salt solution, 43.3° C. (110° F.), into the vagina, and cleanses the lower pelvis with a sponge held in the forceps. The irrigation is continued until the water returns perfectly clear.

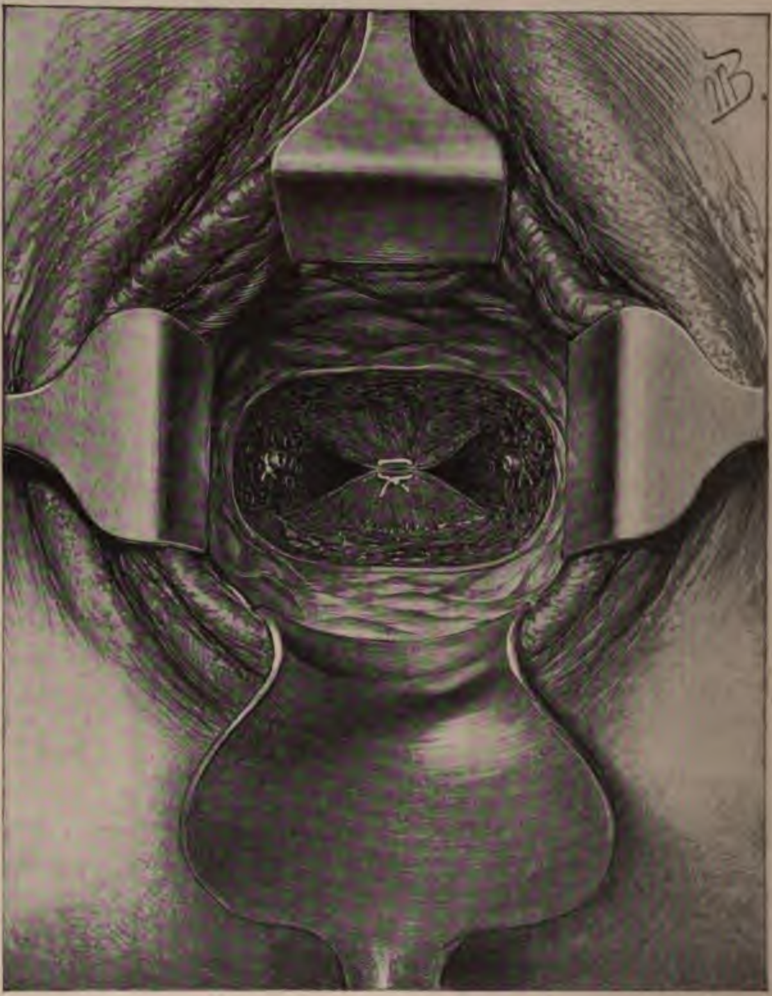

FIG. 351.—VAGINAL HYSTERECTOMY.

The uterus removed, the ligatures on the uterine arteries seen on either side. The anterior and posterior peritoneal layers are brought together in the middle by one suture. The long ligatures on the broad ligaments are left out of this picture.

If omentum, or a loop of intestine, falls into the vagina, it must be carefully pushed back. While washing out the lower pelvis the peritoneum must be inspected as well, in order to discover and remove any coagula lodging there.

The next step is the investigation of the condition of all the ligatures and the search for bleeding points. A slight traction of the upper ligatures, aided by a sponge pushed into the peritoneum, and then partially withdrawn, brings the broad ligament forward, and exposes first one part of it and then another. Any ligature which seems loose must at once be replaced by transfixing the broad ligament at that point. A few fine silk ligatures are usually required to control small vessels under the first ligatures, just below the base of both broad ligaments. A persistent flow from a hemorrhoidal vessel in the recto-vaginal septum must also be controlled by a ligature placed beneath the bleeding point. The wound area underlying the base of the bladder but rarely bleeds.

The ligatures on either side are now tied in two bunches, and the ends cut off just within the vagina (see Fig. 351).

As a final step, the pelvis is dried with a small sponge, and a dressing applied of strips of iodoform or sterilized gauze, 45 cm. (18 inches) long by 5 cm. (2 inches) in breadth. To insert the gauze, the operator, taking the packer, pushes a strip in between the ligatures until the whole space between the broad ligaments is loosely filled out. The vagina below is also packed with gauze somewhat firmly to prevent the intestines from escaping in this direction. This packing of gauze supports the small intestines, omentum, rectum, and bladder, and drains off any fluid into the vagina. Too tight a pack does not drain well. A loose pack, on the contrary, favors prolapse of the bowel into the vagina. I lost one patient through a loose pack, from peritonitis, due to the infection of a knuckle of intestine forced down beside the pack. It is a good plan to unite the peritoneum in the middle by one or two sutures, leaving a little opening on either side for drainage, supporting the intestines and lessening the liability to prolapse. Iodoform and boric acid powder are dusted freely into the vaginal outlet as the speculum is withdrawn.

The urine is now drawn, and, if clear, conveys the assurance that the bladder has not been injured. Bloody urine may indicate an injury to the bladder or ureter. A roll of sterilized absorbent cotton is applied over the vulva, held in place by a T-bandage.

After Treatment.—When the effects of the anesthesia have worn off, it is not necessary to keep the patient on her back. She will be greatly relieved from time to time by being gently turned over on one side or the other; after a few days she may turn on her face and urinate in this posture. At first the catheter should be used three or four times daily. The bowels should be moved on the third day by a laxative pill, followed by a warm enema of oil and soapsuds, or of glycerin and oil, 180 cm. (6 ounces). During the evacuation she must avoid straining. If the fecal matter does not pass out easily, the nurse must assist with her fingers. After this, a movement must be secured every other day.

The diet during the convalescence should consist for the first two or three days of liquids, followed by soft foods, nourishing soups, toast, soft boiled eggs, oyster soup, various starchy foods, etc.

Pain following the operation is often entirely absent and is rarely unbearable. Hypodermics of morphin should be used sparingly to relieve severe pain during the first twenty-four hours.

If the pack continues dry, and there is no discharge from the vagina, it may be left there five days or longer. To remove the pack the patient is brought with the buttocks to the edge of the bed with the thighs flexed. The operator slips a narrow Sims speculum into the vagina, retracting the posterior wall, and with dressing forceps draws out the strips of gauze from between the ligatures. As soon as the strips are removed the vaginal vault must be cleansed with pledgets of absorbent cotton, and a fresh pack inserted.

No vaginal douches of any kind should be used until three weeks have passed, when a 3 per cent warm carbolized or boric acid douche may be given once or twice daily, using a short nozzle and taking great care not to push it too far in. When silk ligatures are used, the discharge is sure to become odorous sooner or later, and the vagina must be cleansed more frequently. The ligatures loosen and come away with a little traction, in bunches, in from four to six weeks. It is a good plan not to wait for them to become detached, but in the course of three weeks to expose and remove them with forceps and scissors. These sutures can be removed most easily with the patient in the knee-chest or Sims posture.

In eighteen days the patient may sit in a reclining chair a little while each day, and after this gradually increase her movements, until after four weeks, when she is able to be up all day. At this time an examination will show that the vaginal vault is closed, and the wound area has contracted down to a transverse granulating linear scar, with the granulations more abundant at each end. After six or eight months this whole line has contracted still more, until it is a thin white cicatrix, closing the vault.

After a hysterectomy the patient should avoid hard work, heavy lifting, and prolonged exertion for several months. Recovery of health is usually rapid: within a few months a pale, emaciated woman often regains all her lost vigor. But the surgeon still has a duty to perform in continuing to watch these cases, examining them at first at intervals of two or three months, and later every six months, in order to detect at once any recurrence of the disease. It will occasionally be necessary to cut out a small area of recrudescence in the vaginal vault, which will be detected at an early stage by this careful inspection.

In two instances in which the uterus was enucleated without removing the uterine tubes or the ovaries I found at a later date the vault of the vagina occupied by dark red, fungus-like masses, which at first sight suggested a rapid return of the disease; on removing these, however, they proved to be the uterine tubes inverted through the incision at the angles, exposing to view their inner mucous lining.

Accidents and Complications.—The accidents and complications that arise during vaginal hysterectomy are:

1. Hemorrhage.
2. Ligation of one or both ureters.
3. Rupture of the bladder.
4. Injury to the small intestine.
5. Pelvic abscess.
6. Ovarian tumor.
7. Incomplete enucleation of the disease.

Hemorrhage.—The various sources of hemorrhage are the hemorrhoidal, uterine, ovarian, and vesical arteries and veins. Slight hemorrhage from small arteries is usually easily controlled by clamping them for a time with forceps; if they continue to bleed they must be ligated with fine silk or catgut. Hemorrhage from such large vessels as the uterine and ovarian arteries may prove embarrassing from the constant flow of blood which obscures the field; the difficulty of managing it is greater in proportion to the distance of the bleeding point within. Such a hemorrhage is most apt to arise from cutting too close to one of the ligatures, so that the short bunch of tissue in its grasp slips from under the constricting loop. The worst form of hemorrhage is seen where the effort has been made to grasp the entire broad ligament in a clamp. This form of hemorrhage is treacherous, because it is liable to occur some hours after the operation.

The following instruments and accessories should always be within easy reach to meet such an emergency: A Sims speculum, two long flat retractors, dressing forceps, three sponges in holders, six artery forceps, perineal pad, iodoform gauze, transfusion apparatus, and a liter of normal salt solution. A hypodermic injection of strychnin ($\frac{1}{30}$ grain) should be given at once.

To control the hemorrhage the patient is put under chloroform and brought to the edge of the bed under a good light, or, better still, placed on a table. As soon as she is sufficiently relaxed by the anesthetic, the operator must proceed rapidly, as prolonged anesthesia is especially dangerous in the shock following an extensive hemorrhage.

The saturated gauze pack is removed, and with fingers and sponges on holders the vagina and pelvis are rapidly cleared of the large clots which sometimes extend high up into the abdomen, even as far as the umbilicus. By gentle traction upon the bunches of ligatures, the broad ligament of one side and then that of the other is drawn into view, the loose ligature loop found, and the broad ligament clamped. If active hemorrhage is going on, the quickest way to detect its source is to introduce a clean sponge on a holder between the broad ligaments and leave it there for a few seconds. The deep blood stain in one spot reveals the corresponding position of the hemorrhage. If, however, the precise area can not be determined by inspection, the broad ligament on the bleeding side should be caught by traction forceps, introduced under the guidance of the index finger, and drawn down step by step until the bleeding point is seen. As soon as discovered, a pair of artery forceps is applied, or several forceps in rapid succession if needed, until the whole area is under control. If the patient is much shocked by loss of blood, the quickest and most satisfactory plan is to leave the forceps in place for from thirty-six to forty-eight hours, without attempting to apply a ligature. When a large area of the broad ligament has slipped up into the pelvis and the bleeding is active, if proper assistance is wanting, a bold and successful method of finding the bleeding vessels is to take a pair of bullet forceps and carry them up into the pelvis, guiding them by the touch; the broad ligament is then seized and drawn down into view, and so clamped from end to end with artery forceps. The operator must constantly bear in mind that an active hemorrhage almost invariably arises from one of four vessels, the two uterine and the two ovarian arteries; each one of these must be inspected in searching for the source. A persistent exhausting hemorrhage may also arise from patulous atheromatous vessels in the septum between bladder and cervix or between cervix and rectum. One of my patients nearly lost her life in consequence of a slow continuous oozing from a small vessel of this sort.

Where the mucous surfaces are blanched by the hemorrhage, the respiration quickened, and precordial distress felt, with a rapid, thready, scarcely perceptible pulse, or even where there is only well-defined shock, infusion of a liter of salt solution under the breasts should be resorted to during the operation.

Ligation of One of the Ureters.—This is an accident to which a beginner is peculiarly liable, and comes from passing the first ligatures too far out from the cervix toward the pelvic wall.

The most skilled operator however may make this mistake, when the cervix is unusually enlarged by cancerous infiltration, diminishing the distance to the pelvic wall, and bringing the cervix and the ureters into abnormally close relationship. In such cases the only absolute assurance of safety lies in a preliminary sounding of the ureters, by placing a flexible bougie in each one, where it remains until the operation is over (see Chap. XVIII. By this means, as soon as the peritoneum is opened, the ureter can be felt at once against the side of the pelvis like a hard, firm cord, which the bougies keep splinted out upon the pelvic wall at the greatest possible distance from the cervix. The extreme importance of placing a sound in the ureters has been repeatedly illustrated in my cases where the ureter has been bared for one or more inches by a careful dissection.

Rupture of the Base of the Bladder.—This accident will not occur in an ordinary vaginal hysterectomy, if the uterus is free from its vesical attachments by constantly directing the end of the finger toward the cervix. Occasionally the operator will be surprised by discovering that the disease has extended beyond the cervix and involved the base of the bladder, which breaks down, allowing the finger to enter the bladder in the enucleation, in spite of every precaution. This accident is signalized by a gush of urine mixed with blood. The exact location of the tear should at once be determined, either with the finger, or by introducing a sound into the bladder through the urethra, and bringing the point out through the hole.

Care must be taken during the further steps of the operation not to convert a small rent into a large ragged opening. If the danger of further rupture is imminent, while using the finger, the remainder of the bladder may be dissected off from the cervix with forceps and scissors. As soon as the extirpation of the uterus is complete, the rent in the bladder should be exposed by a little traction on its peritoneal fold, and, if there is any suspicion of infiltration, the margins of the rent should be liberally excised, the fistula closed by interrupted silk sutures, not including the mucosa, the vesical peritoneum drawn down over the closed fistula and attached to the anterior vaginal wall, thus burying the fistula and relieving it of any tension as the bladder distends with urine. After such a complication, the urine should be drawn every four hours for two or three days. If the approximation is good, this operation is almost invariably successful; convalescence will not be complicated by a vesico-vaginal fistula.

Injury to the Small Intestine.—The small intestine may be injured where adhesions to the uterus have been formed, in consequence of pelvic peritonitis of tubal origin, or from extension of cancer of the body of the uterus to the contiguous viscera.

By palpation on opening the peritoneum and a careful separation of adhesions, any serious injury to the bowel will usually be avoided, and its lumen will not be opened unless invaded by the disease; in such a case the best plan is to draw the affected loop of bowel down out of the pelvis, cut out the diseased area, and close the opening by sutures. Such cases as these ought not to be operated on through the vagina if the extent of the disease is suspected beforehand; an abdominal incision reveals the exact condition, which can then be dealt with under actual inspection.

Pelvic Abscess Complicating Vaginal Hysterectomy.—Vaginal hysterectomy, where there is an abscess in one or both tubes and ovaries, is made more difficult by the fixation of the uterus through the inflamed adherent lateral masses, which interfere with the downward displacement. The danger of general peritonitis is also enhanced by the contamination of the pelvic peritoneum by the escaping pus. The best plan of procedure is to go on as far as possible with the enucleation of the lower part of the uterus without rupturing the abscess, and then to protect the peritoneum thoroughly with a gauze pack, while evacuating the pus with an aspirator.

When the peritoneum is opened, gauze should be packed in on all sides to protect the abdominal cavity.

If the abscess involves but one side, the unaffected side should be freed first and the uterus brought out, when the affected tube and ovary may be removed with the uterus by introducing two fingers, separating the adhesions and drawing the organs outside, and then ligating and cutting, first the ovarian vessels near the line of the pelvic brim and continuing on down the broad ligament until the whole mass is freed.

If the abscess has ruptured and its contents escaped over the peritoneum and the wound, some of the pus should at once be examined under the microscope for organisms, and if any of the various pyogenic cocci are found in abundance, the sponging out should be more thorough, the whole pelvis being washed with extreme care, and a more abundant gauze drain should be placed higher up within the pelvis at the end of the operation.

If the enucleation is impeded by an ovarian tumor, this should be freely opened and after evacuation drawn out in a collapsed condition; the ligatures are then applied to the broad ligaments as usual.

Incomplete Enucleation.—An incomplete enucleation is the result of an operation undertaken by mistake when the disease is too far advanced for radical treatment, and I know of nothing more unsatisfactory than the discovery, after the operation is well under way, that a portion of the disease has advanced beyond the possibility of removal. One may find a nodular mass adhering by a broad base to the pelvic wall, or an infiltration of the upper part of the broad ligament through which it is necessary to cut to free the uterus: or, again, the uterus may be so friable as to break down as soon as it is handled, leaving a ragged infiltrated area extending into the broad ligament.

Separate masses plastered on the pelvic wall must be let alone, for complete extirpation is here impossible, and the attempt would excite a hemorrhage which might easily become uncontrollable.

Where the broad ligament is found widely infiltrated after the operation has advanced too far to be abandoned, the uterus must be removed as nearly as possible in one piece and any remaining cancerous areas with friable tissue energetically curetted, the hemorrhage checked with forceps left on from twenty-four to forty-eight hours, the pelvis washed out with the utmost care, and an extensive gauze pack inserted, completely enveloping the infiltrated area on all sides.

CHAPTER XXII.

PROLAPSE OF THE UTERUS.

1. Definition (p. 619).
2. Forms of prolapse (p. 619): *a.* Entire uterus. *b.* Cervix. *c.* Vesical diverticulum. *d.* Prolapse without vesical diverticulum. *e.* Rectal diverticulum. *f.* Enterocele. *g.* Prolapse with complete tear.
3. Accurate description of cases necessary (p. 626).
4. Causes of prolapse (p. 627): *a.* Congenital. *b.* Strain. *c.* Childbirth.
5. Symptoms and complications (p. 628).
6. Operative treatment (p. 629): *a.* Simple prolapse: 1. Supravaginal amputation of cervix. 2. Resection of lax outlet. 3. Anterior colporrhaphy. 4. Suspension of the uterus. *b.* Complicated prolapse: 1. With complete tear of septum. 2. With prolapse of rectum.

Definition.—Prolapse of the uterus and falling of the womb are terms applied to a hernia, sometimes appropriately called "sacro-pubic hernia" (Hart), occurring at the vaginal outlet, in which the uterus lies within the hernial sac.

Although the term "falling of the womb" is sanctioned by long usage, it is seriously misleading, inasmuch as it implies nothing more than a simple displacement of the uterus, which in fact never occurs alone, but is always associated with eversion of other important structures, usually the vaginal walls and a part of the bladder, these organs hanging together out of the vulvar cleft below the pubic arch, like a large mucous pouch.

An illustration of an extreme form of prolapse, representing the most advanced degree attainable, is furnished by one of my patients, a woman thirty-two years old, with complete eversion of both vaginal walls, and complete prolapse of the retroflexed uterus as well. The sketch shows the relations of the sac as viewed from the side (see Fig. 356).

Forms of Prolapse.—Under the comprehensive title "prolapse" are gathered a variety of interesting forms which may, however, be arranged under two cardinal divisions—prolapse of the entire uterus, and prolapse of the cervix only.

In the first case the uterus descends as a whole, the fundus sinking *pari passu* with the cervix, following it out as it passes beyond the vaginal outlet; in its descent the uterus occupies an infinite number of positions between the normal anteflexion, and a condition of complete extrusion.

In the second case the fundus of the uterus descends but slightly in the pelvis, while the cervix, advancing more rapidly, escapes at the outlet, with the everting vaginal walls; this form of prolapse involves only the lower extremity of the uterus and is therefore incomplete.

A good illustration of the elongation of the cervix just above the vaginal vault is afforded by the relations of the parts in one of my patients.

Here there was a little atrophic cervix at the end of a prolapsus hanging 7 cm. (3 inches) below the vulva. The sac was but 10 cm. (4 inches) in circumference. The length of the uterine canal was 11 cm. (4¼ inches), and the body of the uterus lay entirely within the pelvis. A diverticulum of the bladder

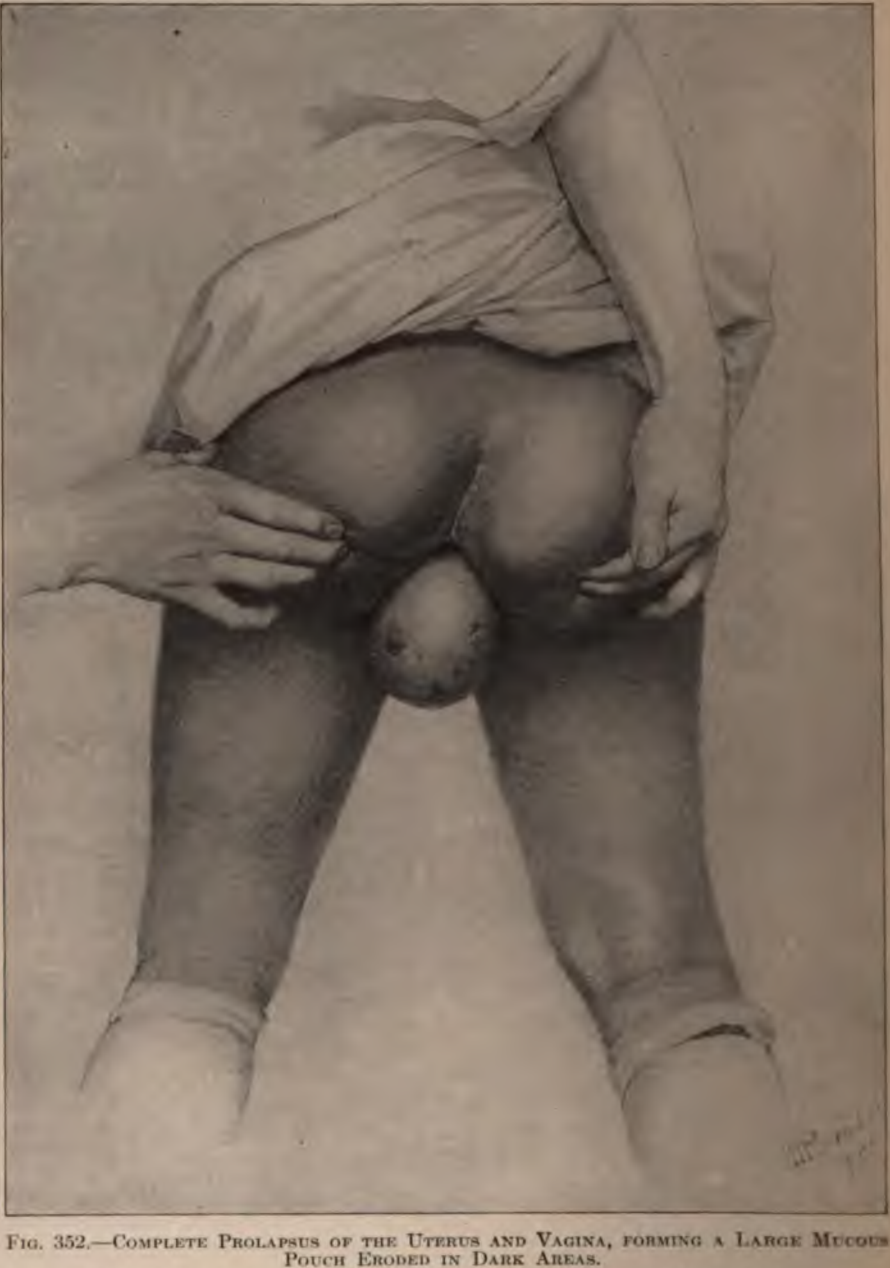

FIG. 352.—COMPLETE PROLAPSUS OF THE UTERUS AND VAGINA, FORMING A LARGE MUCOUS POUCH ERODED IN DARK AREAS.

The patient, a negress, is seen from behind, in order to expose the sac better.

entered 3½ cm. (1½ inches) into the sac, while the rest of the bladder extended 9 cm. (3½ inches) up into the pelvis. On returning the sac, nothing was apparent but a relaxed outlet and a cystocele of moderate size.

This remarkable displacement owes its occurrence to a ductile condition of the supravaginal portion of the cervix, where it joins the uterine body, allowing it to be drawn out from 3 to 6 cm. (1 to 2½ inches) longer than normal.

Variations of these two cardinal divisions of prolapse are formed by the presence of a longer or shorter bladder diverticulum, or even by the absence of any portion of the bladder within the sac.

A rectal diverticulum may be found in the prolapsed posterior vaginal wall, but is one of the rarer complications. The presence of small intestines in the sac in front of or behind the uterus (anterior or posterior enterocele) is an unusual complication; it is most rarely found in front, as this space is usually filled by the bladder.

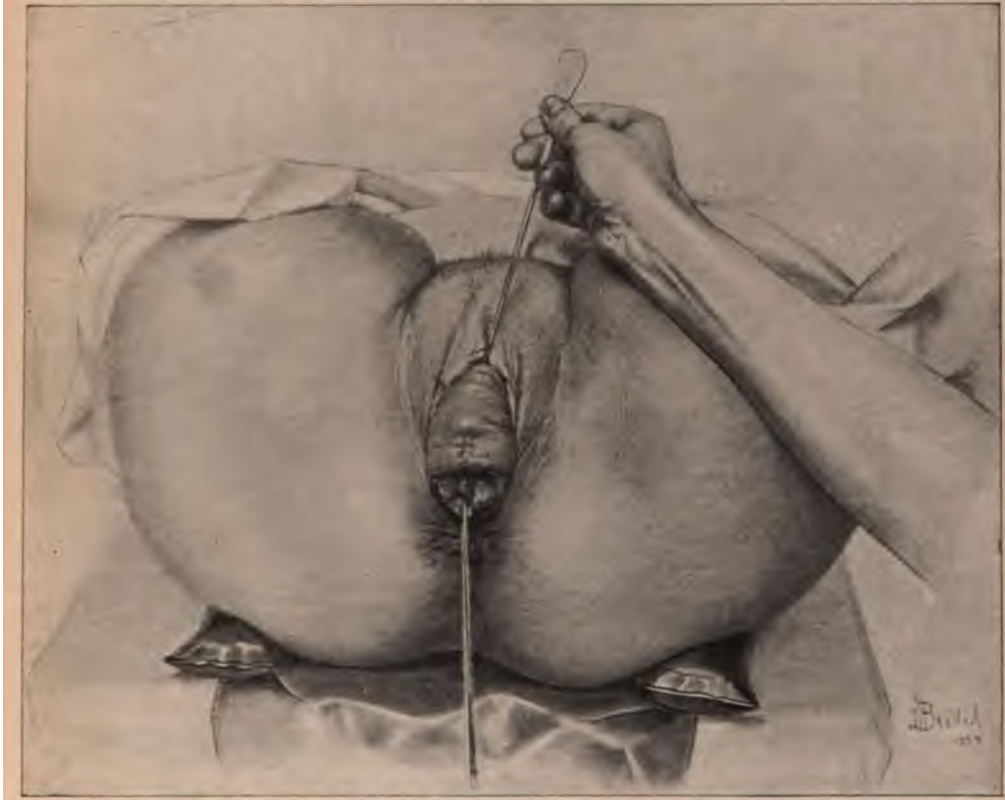

FIG. 353.—PARTIAL PROLAPSE OF THE UTERUS AND VAGINA, WITH ELONGATE LACERATED CERVIX.

The sound is introduced into the bladder to show the altered direction of the urethra and the vesical diverticulum in the sac. The light spot plainly shows the position of the end of the sound in the bladder.

Prolapse of the uterus with complete rupture of the recto-vaginal septum is also rare. The rarest of all forms is that of complete prolapse with rupture of the septum and prolapse of the rectum.

In investigating the relations of the body of the uterus to the sac, in complete displacement, the fundus will in some rare instances be found lying either in marked anteflexion or in marked retroflexion.

The Vesical Diverticulum.—The bladder, in close anatomical relation with the cervix, almost always accompanies the uterus in its descent. A part of the bladder only is involved in most cases, the greater portion still remaining within the pelvis, attached to the pubis and lower abdominal walls by its suspensory ligament. The bladder is thus divided into two lobes, with constriction at the neck of the prolapse. In one of my cases the intra-pelvic portion was so large that the sound entered 11 cm. (4½ inches) and struck the sacrum. The lobe in the sac is no longer under the control of the vesical muscles, and therefore is incompletely emptied. On this account urine will accumulate and cystitis arise from its decomposition; calculi may even be formed.

In one of my cases, a woman of sixty-eight, a large sac hung out at the vulva 12 by 9 by 8 cm. (5 by 3½ by 3 inches). The vagina was completely everted, and the uterus lay entirely within the sac. In the middle of the sac, in the diverticulum of the bladder, lay a large calculus. The intra-pelvic portion of the bladder contained a second stone of equal size. She had also passed three small calculi before I saw her. The calculi were removed by an incision 4 cm. (1½ inches) long through the prolapsed anterior vaginal wall, beginning 3 cm. (1 inch) above the cervix. The mucous membrane of the bladder was found thick and inflamed and covered with false membrane in places. The incision was closed at once with silkworm gut sutures, and the prolapse operated upon at the same time by the method about to be described. The wounds all healed and the patient was entirely relieved.

The urethra sometimes presents a marked deviation from its normal direction, the external orifice being displaced forward and upward, while its canal curves down into the sac.

Involvement of the ureters in the displacement may give rise to hydroureter and hydronephrosis. From the frequent and futile efforts of the bladder to expel the residual urine, its walls may become enormously hypertrophied: in other cases they may stretch and become thin.

Prolapse without Vesical Diverticulum.—Prolapse without vesical diverticulum is occasionally though rarely found, the bladder remaining entirely within the pelvis, being separated from its uterine connections. An interesting case of this character entered my clinic in April, 1891 (see *Johns Hopkins Hospital Report in Gynecology*, vol. iii, p. 311). The accompanying figure (355) represents the appearance at the time of the first operation. The patient (M. K., 653, April 4, 1891) was thirty-two years old, of slight build, weighing less than one hundred pounds, married ten years, and the mother of three children—nine, seven, and three and a half years old. Both cervix and perineum were torn in an unassisted first labor, and a protrusion at the vulva was noticed then, which increased after the birth of a second large child; after this she suffered from excessive constipation, frequent micturition, and dragging pains, and the effect of the third labor was a prolapse which hung 10 cm. (4 inches) below the vulva.

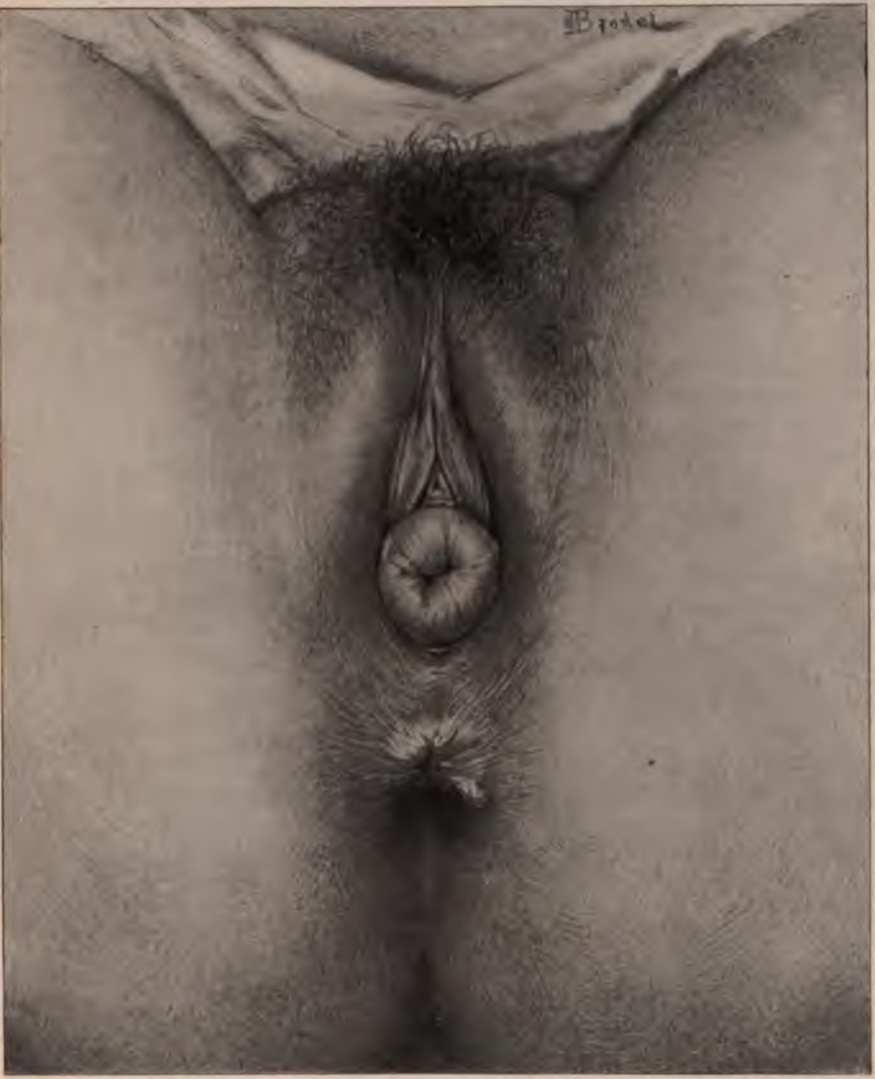

Fig. 354.—Partial Prolapsus; Eversion of the Anterior, Posterior, and Lateral Vaginal Walls.

The vaginal canal is seen in the middle, and the cervix is still invisible within the pelvis.

I found at my first examination a large sac between the thighs dependent from the vulvar orifice, and the anterior wall of the vagina everted from cervix to urethral orifice, the vagina posteriorly, on the contrary, presenting a depth of about 7 cm. (3 inches) within the pelvis. The uterine cavity measured 7 cm. (3 inches) in length. The body of the uterus was still within the pelvis in a direct line with the axis of the sac. There was no apparent elongation or thinning of the supravaginal cervix felt through the sac wall. The anterior and posterior parts of the prolapse were distended with soft, irregular masses, gurgling on pressure, and tympanitic on percussion. These masses were easily reducible and were evidently coils of intestines. The urethra lay just beneath the pubic arch. Upon introducing a sound within the bladder, it entered the pelvis 8 cm. (3 inches) in the median line, and 9 cm. (3½ inches) on either side, but no part of the bladder entered into the sac.

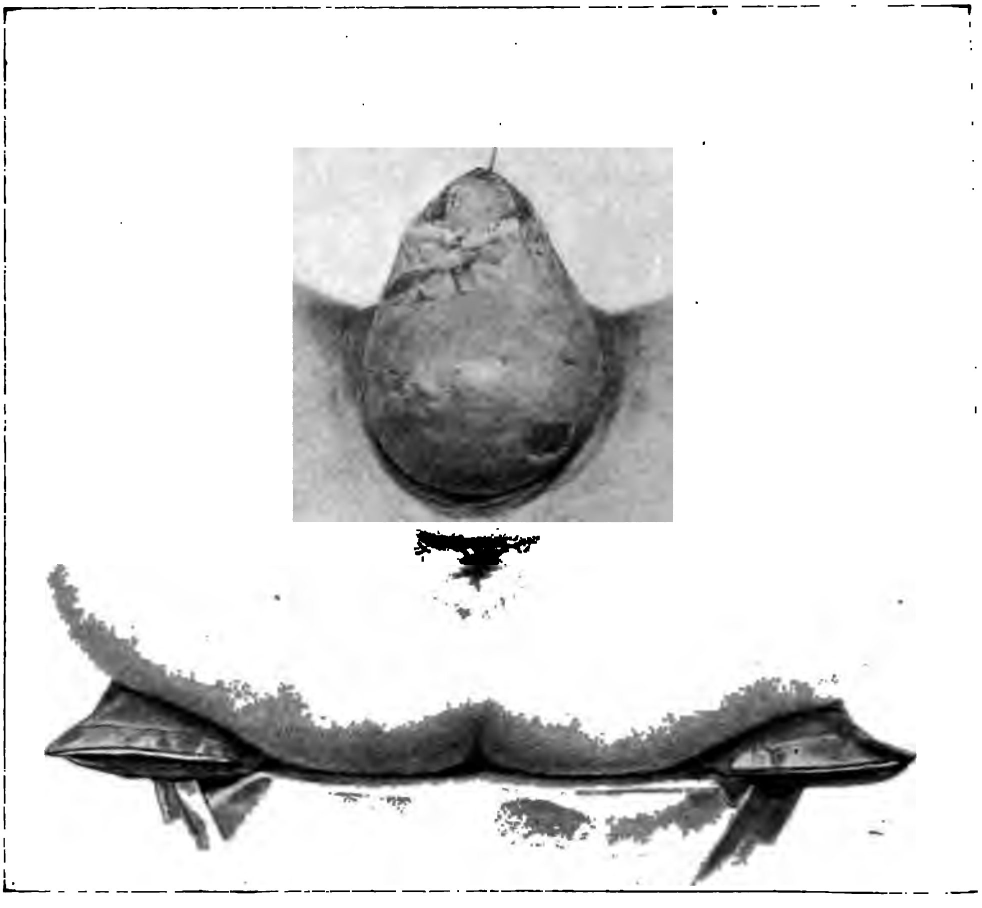

FIG. 355.—COMPLETE PROLAPSE OF THE VAGINA AND UTERUS, WITH RETROFLEXION OF THE PROLAPSED UTERUS, AS IS EVIDENT FROM THE DOMELIKE PROMINENCE ON THE UNDER SURFACE OF THE SAC.

The lacerated everted cervix and areas of ulceration are plainly seen.

I should explain the absence of vesical diverticulum in this way. The tendency of the bladder when markedly distended is to assume the spherical or ovoid form, which accommodates the largest amount of fluid in the smallest space. In a prolapse, in the process of formation, the upper lobe of the bladder in expanding constantly exerts traction upon the lower lobe and tends to draw it up out of the sac into the pelvis, by which means the cellular attachments between uterus and bladder are stretched and yield more and more, until the separation is complete and the whole bladder comes to lie free in the pelvis.

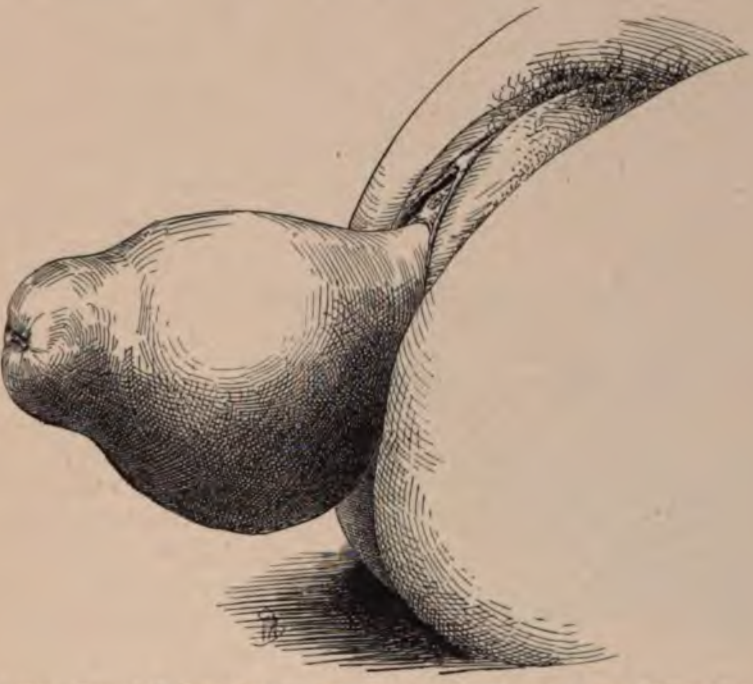

FIG. 356.—COMPLETE PROLAPSE OF THE VAGINA AND UTERUS, WITH RETROFLEXION.
Note the narrow neck at the junction with the body, and the prominence posteriorly. M. K., 653.

This separation of the uterus from the bladder may go on progressively with the descent until the prolapse is complete. With the bladder thus lying in the pelvic cavity, while the uterus is prolapsed, the vesico-uterine has become transformed into a utero-vaginal pouch in front, analogous to the recto-uterine one behind.

In but one case have I seen the bladder lying entirely within the prolapse, without any portion in the pelvis or attached to the symphysis. At a subsequent examination, when the bladder contained more urine, it was found extending back toward the sacral hollow.

In addition to the form of enterocele described, another form in which the intestines crowd into the sac posterior to the uterus is more frequently found.

A rectal diverticulum is rarely found in the prolapse, although it may happen, and a considerable fecal stasis be discovered at this point. The relation of the anterior wall of the rectum to the sac may be readily ascertained by introducing the finger within the bowel. These various possible complications must all be noted before operation on account of the danger of opening the peritoneum or the bowel.

Complete tear of the recto-vaginal septum is not often found with prolapse; this is due to the fact that the direction of the tear for the most part is central, and so does not involve the levator ani muscle to any great extent, leaving the outlet well supported. In a small percentage of cases, however, the association is observed.

An unusual complication is prolapse associated with vesico-cervico-vaginal fistula. I operated on such a case April 9, 1892. The patient (K. W., 1320) was fifty-three years old, and had a large prolapsus sac with an irregularly torn, posterior cervical lip; the anterior lip was gone, and in the midst of a mass of scar tissue in its place, was a fistula 2 mm. in diameter. The cervix was elongated, the fundus uteri remaining in place in the pelvis. She had been operated upon unsuccessfully twenty-one years before by Prof. Nathan Smith, of Baltimore, and had become a confirmed opium eater. I made the classical oval denudation on the vaginal mucosa 3 cm. (1 inch) long, funnel-shaped, with the bladder mucosa at the apex, and united the edges of the wound from side to side with interrupted silkworm gut sutures. The whole operation was peculiarly easy with the parts lying displaced exteriorly. She was carefully watched throughout her convalescence, during which the opium habit was broken, and the fistula cured.

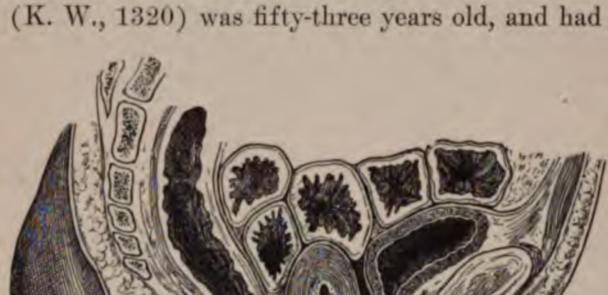

Fig. 357.—Partial Prolapse of the Uterus, with Partial Eversion of the Posterior Vaginal Wall and Complete Eversion of the Anterior Vaginal Wall.

The cervix is elongate. The point of special importance is the complete detachment of the bladder from its uterine and vaginal attachments, with the presence of the intestines in the sac both anterior and posterior to the uterus (vaginal enterocele).

One of the rarest complications is that presented by a patient, fifty years old, who had a prolapse with hypertrophic elongation of an infiltrated lacerated cervix, and just below the cervico-uterine junction a complete atresia of the uterine canal.

Prolapse cases differ so widely in their individual features that all operators should make note of the following characteristics:

Dimensions of the prolapsed sac.

Appearance and position of the cervix.

Presence of ulcerated areas.

Complete or incomplete eversion of both anterior and posterior vaginal walls.

Length of uterine canal, noting whether the cervical portion is drawn out.

Exact position of the fundus uteri—in the pelvis or in the sac.

Relations of the bladder to the sac.

Relation of the rectum to the sac.

Position of the peritoneal pouch, posterior to the sac.

Presence of intestines in the sac.

Appearance of the outlet when the sac is returned.

Pelvic measurements, to explain, if possible, the cause of a difficult labor.

Causes of Prolapse.—Congenital defects in the vaginal outlet and pelvic floor may supply the factors necessary for the formation of a prolapse which may be found at birth. Protrusion of the pelvic viscera has been observed from the strain of a fall.

But the conditions essential to the production of a prolapse are most frequently found after multiple pregnancy. The large, heavy uterus following a puerperal infection, by its weight alone predisposes to prolapse when the woman has gone to work too soon. The direct causal relationship between labor and prolapse is shown by the fact that in thirty-five of my cases there was but one who had had no pregnancy, and here the prolapse was but partial.

Twenty-seven women of whom I have accurate notes had had an average of 3.8 children. Nine of these women had borne children after the appearance of the prolapse.

A tight obstetric binder, by throwing the uterus into retroposition, also favors prolapse. If the binder is used, it must under no circumstances be applied tightly within the first ten days after labor. To aid the uterus in regaining its normal size the patient should remain in bed for two weeks, during which time the physician should from time to time assure himself of its position by palpation through the abdominal walls, drawing the fundus forward if he finds a tendency toward retroflexion. It is best for her not to lie much in the dorsal position, but to turn in bed as often as she wishes, assuming any comfortable posture. Cases of prolapse will also be avoided if retroflexion and relaxed outlet receive timely treatment.

Prolapse owes its origin, therefore, to an insufficiency of the intrapelvic uterine supports associated with a weakness of the pelvic floor.

A tight, well-closed vaginal outlet, depending upon the integrity of the anterior part of the levator ani muscle, is the most important factor in retaining the uterus within the pelvis. This muscle controls the outlet and prevents prolapse in three ways: (1) It retains the normal outlet in its position forward under the pubic arch, out of the line of abdominal pressure; (2) it gives to the outlet the size and form of a narrow slit, preventing the protrusion of the pelvic viscera; (3) it directs the axis of the vaginal canal forward instead of directly downward, so that the intra-abdominal pressure strikes the pelvic floor at a right angle.

If these functions of the levator ani are impaired or destroyed by extreme dilatation or laceration of its fibers, the vaginal outlet is no longer supported, but drops open and falls back toward the sacrum, and the canal assumes a direction more or less in a direct line with the abdominal pressure, the first effects of which are to crowd the adjacent anterior and posterior vaginal walls down into the outlet, still further distending it.

If the body of the uterus is retained within the pelvis by its broad ligament attachments, as the cervix descends, the portion between the cervix and the body becomes drawn out and thin, a condition readily diagnosed by squeezing the sac between the fingers, when the upper portion of the cervix is felt in the middle like a long, thin cord.

The essential intrapelvic supports of the uterus are those which tend to keep its upper pole (the fundus) in front, and its lower pole (the cervix) in the back part of the pelvis. The attachment of the vesico-uterine peritoneal folds high up on the anterior face of the uterus serves to hold the fundus behind the symphysis, while the utero-sacral muscles at the opposite pole serve to hold the cervix back. So long as these supporting structures remain intact, displacement can not occur. If, however, the utero-sacral folds relax, the cervix drops away from the sacrum in the only possible direction, down the vagina. The body of the uterus then remains no longer cushioned upon the upper surface of the bladder, but at once begins to hang as a dead weight, and is forced step by step down upon the pelvic floor by the force of gravity, combined with the intra-abdominal pressure (see Fig. 358). In the descent the cervix is involved first and the fundus next, and it is only a question of time when the prolapse will be complete. Retroflexion of the uterus is often but an initial step in the formation of prolapse, which will occur when the retroflexion is associated with a relaxation at the vaginal outlet.

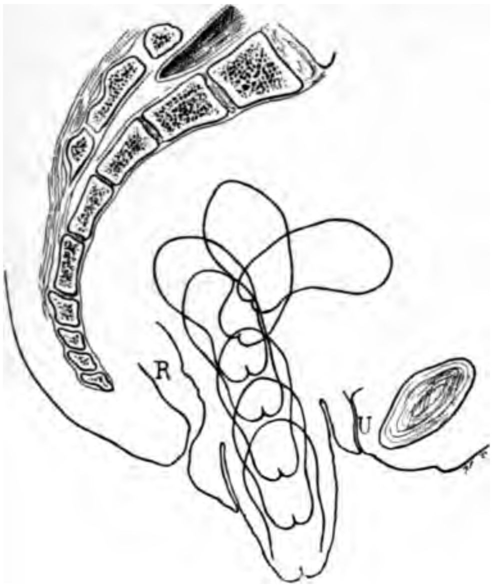

Fig. 358.—Prolapse of the Uterus, showing the Intermediate Stages between the Uterus in Anteflexion and in Complete Prolapse.

First the uterus descends a little and drops into retroflexion; then it descends farther and the flexion is straightened out; then the cervix appears at the vaginal outlet, to escape beyond it in the next stage; and, finally, the whole uterus lies outside, inclosed in the vaginal sac.

Symptoms and Complications.—I find that in 35 of my cases the average age was forty-two years, and that only 4 were below thirty, 2 however were but nineteen years old; 10 were between thirty and forty, 8 between fifty and sixty, and 13 between forty and fifty.

The most distressing symptoms of prolapse are backache, and a dragging sensation in the pelvis and lower abdomen, producing a general feeling of weakness; locomotion is often painful—as one patient expressed it, she always "felt as if she could go no farther." Sitting is sometimes painful. Frequent urination is common; the bowels are often constipated and the appetite poor.

From stagnation of urine in the vesical diverticulum, intense cystitis is sometimes found. The bladder walls first become thickened and the ureters are compressed. The infection often travels up to the pelvis of the kidney, producing pyelonephrosis and death. In rare cases calculi are found in the pouch.

In one of my cases there was a complete prolapse with retroflexion and a myoma on the posterior wall of the fundus. This was about 3 cm. in diameter and made a distinct elevation on the everted vaginal surface.

The vaginal mucous membrane covering the sac loses its rugose appearance, becomes smooth, hypertrophied, and callous. Rubbing on the thighs and garments often causes ulcers with deep, sharply defined borders.

Operative Treatment.—The normal supports of the uterus and vaginal outlet can never be perfectly restored. Therefore that operation is best which offers the most efficient substitute. I prefer the following procedure: A resection of the relaxed vaginal outlet, restoring its caliber, altering the direction of its axis, and changing its position, associated with a supravaginal amputation of the cervix; in bad cases the abdomen is opened and the uterus suspended to the anterior abdominal wall.

The resection of the vaginal outlet alone is not sufficient when there is a ductile cervix, which will afterwards worm its way out of the smallest canal; amputation of the cervix deprives the uterus of its leader, as it were, and is always necessary except when it is unusually small or senile.

Hysterectomy is not necessary to cure prolapse, and if the operations upon the outlet and cervix are skillfully performed, it will not often be necessary to suture the uterus to the anterior abdominal wall. Where there is extreme relaxation, and the outlet has not been satisfactorily lifted up by the resection, a suspension of the uterus to the anterior abdominal wall is then advisable (see Vol. II, Chap. XXIX). This, however, will never be sufficient by itself.

Amputation of the Cervix.—To amputate the cervix both anterior and posterior lips are caught with tenaculum forceps and pulled well out of the body; or instead of tenaculum forceps, two long, stout silk sutures may be passed through both lips of the cervix and used as tractors. A circular incision is made immediately above the cervix through the vaginal wall and the uterus pulled downward, while the vaginal vault is stripped off with the thumb and first and second fingers pressing against the cervix, and rubbing the vagina up in front and behind. The separation is always incomplete at the sides where the vessels enter the uterus. Injury to the bladder will be avoided by directing the force of the separating movement toward the cervix, and by occasionally inserting a sound into the bladder in case of doubt as to its exact relations.

The amount of cervix bared is 5 to 6 cm. (2 to 2½ inches). The uterine vessels on each side of the cervix are now tied as high up as possible by a catgut ligature passed close to the side of the cervix. This materially lessens the hemorrhage in the subsequent steps. It is not necessary to expose the peritoneum either in front or behind, although no harm will be done if it is opened.

The cervix is now amputated; it is first split from its external orifice to the upper limit of the denudation, after which the lips are drawn apart and a stout curved needle, carrying a catgut suture, is entered at the anterior vaginal wall close to the incision, carried under any oozing points in the loose cellular tissue in its track, and made to emerge on the mucosa in the cervical canal 4 or 5 mm. below the angle of the slit. A similar suture is passed through the vaginal wall and the posterior cervical lip. After this, several other sutures are passed on either side of these, and the cervical lips are amputated in such a manner as to leave the canal the most prominent portion on the stump. The vaginal mucosa is then drawn in to the cervical mucosa by means of these sutures, which are now tied.

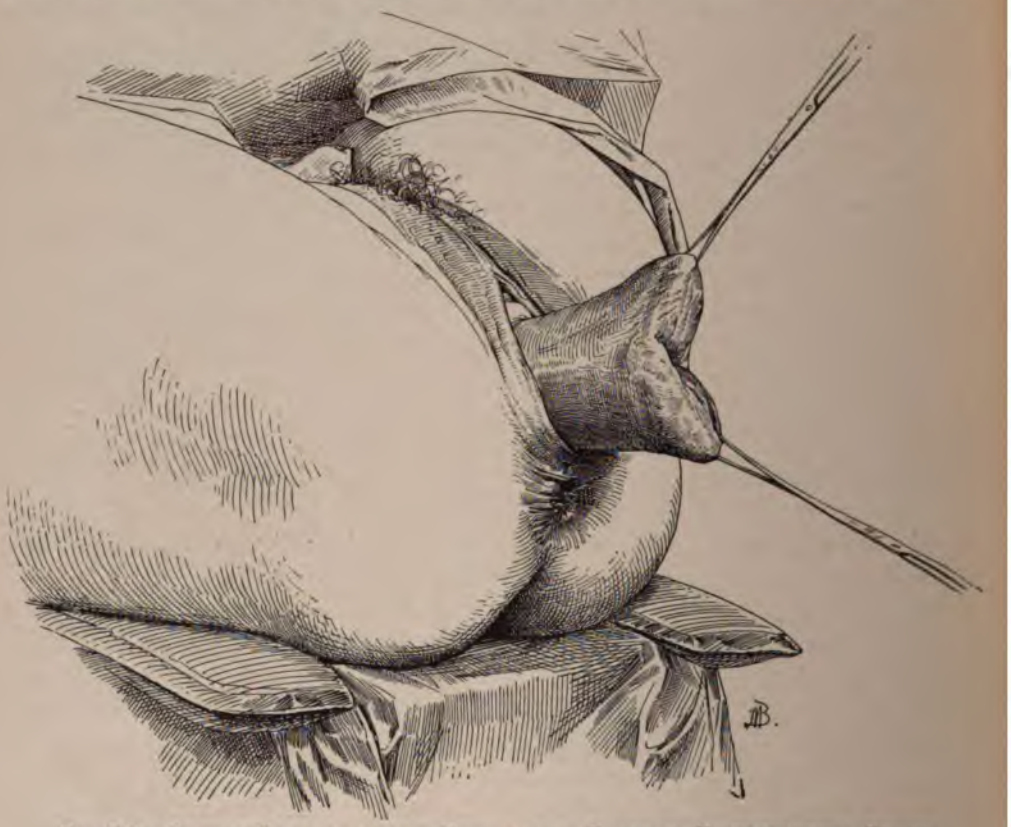

FIG. 359.—PARTIAL PROLAPSE OF THE UTERUS, WITH ELONGATE HYPERTROPHIED CERVIX. The cervix is drawn down and held for the circular amputation, the first step in the operation.

The elliptical openings in the vaginal vault to the right and left of the cervical canal are closed by three or four catgut sutures, bringing vaginal mucosa to vaginal mucosa, and passing under the deep parts of the wound, so as to include all bleeding vessels in their embrace. These sutures must be so applied as not to leave any pockets beneath the surface, as blood is certain to accumulate and distend such spaces, causing infection, which will work its way to the surface at a later date in the form of an abscess.

The only large abscess I have ever seen in the cellular tissue anterior to the uterus was in a patient who had been operated on for prolapse at another clinic, and came to mine with high fever and severe pain, when I discovered and opened an abscess between the uterus and the bladder containing about 150 c.c. (5 ounces) of pus.

Accurate superficial approximation of the wound at the vault is secured by fine catgut sutures between the deep ones.

This first step in the operation does not occupy longer than ten or fifteen minutes.

Resection of the Vaginal Outlet.—The resection of the vaginal outlet in these cases is in general similar to that described in Chapter XV. The only important difference lies in the greater length and breadth of the triangles of denudation extending up into the vaginal sulci, which resect a larger area of the vagina. It is both more difficult and more awkward to outline the area to be exsected within the vagina, on account of the laxity of the tissues and the fact that the well-defined posterior column has disappeared, and in its place is a thick, wrinkled, redundant mass. The line between anterior and lateral walls is fortunately distinct, affording a guide for the outer border of each triangle, just under and parallel to it. The undenuded tongue in the middle, which is left to form the floor of the new vagina, must be made narrow as well as long.

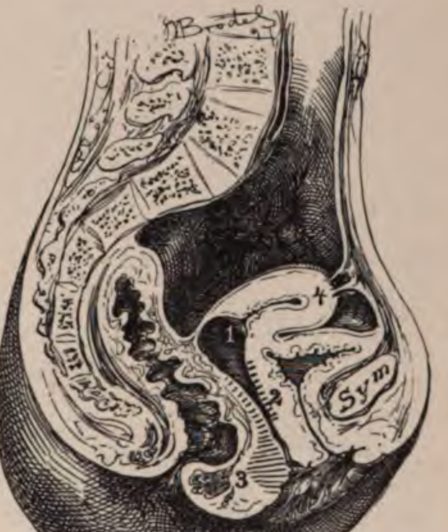

Fig. 360.—Operation for Prolapse of the Uterus by Amputation of the Cervix.

Amputation of the cervix at 1, oval resection of the anterior vaginal wall at 2, restoration of the vaginal outlet at 3, and suspension of the uterus at 4.

It is of the utmost advantage in some of these cases to lay bare the **levator ani** muscles in the right and left sulci, and to pass two or more of the buried catgut sutures used to close the perineal wound through the levator muscular fibers, in such a manner as to draw the muscles together in the median line. (See Holden's method of repairing the relaxed vaginal outlet, Figs. 180–183; and also an article by Chaput, "De la myorrhaphie antérieure des releveurs de l'anus dans le traitement des prolapsus génitaux de la femme," *Rev. de Gyn.*, May--June, 1905, p. 527.) A few buried catgut sutures may be used with advantage to assist in securing accurate approximation. The support given by the levator ani muscles utilized in this way becomes a powerful factor in the support of the uterus.

Anterior Colporrhaphy.—While in a large percentage of cases the anterior vaginal wall is well supported by the resection of the posterior vaginal wall, occasionally the "cystocele," or prolapsed bladder, persists in pouting out at the vaginal orifice, which in course of time it dilates, and so destroys the effect of the operation.

An anterior colporrhaphy for the relief of the cystocele is indicated only in cases of extreme relaxation.

The essential step in the operation for cystocele is the removal of an oval piece of tissue large enough to reduce the hernia and to support the base of the bladder without encroaching upon the proposed field of operation upon the posterior wall.

The operation for cystocele should follow immediately upon the amputation of the cervix, and so forms the second step in the train of three operations—namely, amputation of the cervix and closure of the vaginal vault, resection of the anterior vaginal wall for cystocele, and resection of the relaxed vaginal outlet.

The cervical and the urethral extremities of the cystocele are grasped with tenaculum forceps, pulling in opposite directions and drawn down into the vaginal outlet, while the lateral walls of the vagina are held away by flat retractors.

An oval incision, 4 to 6 cm. long and 2½ to 3 cm. broad, through the entire thickness of the vaginal mucosa, outlines the area to be denuded. If the denudation is made too broad the suturing of the posterior vaginal wall in the next step will be difficult.

The separation of the flap which has been outlined may be effected by loosening one of its ends and then completing the detachment by a blunt dissection with the fingers; constant care must be taken not to tear the bladder wall which is exposed. The wound made in this way does not usually bleed much, and any hemorrhage may be controlled by the interrupted silkworm gut or catgut sutures, introduced from side to side across the axis of the oval denudation, about 1 cm. apart. The sutures must not penetrate the bladder or catch the ureters. On tying the sutures only a linear wound is left. They may be removed in about two weeks.

Suspension of the Uterus.—In those cases in which the vagina has been completely everted, the lax outlet is resected with difficulty, and there still exists a marked tendency of the uterus and the upper part of the vagina to bear down upon the repaired outlet. A decided mechanical advantage will be secured by making a small abdominal incision just above the symphysis pubis, and attaching the posterior surface of the uterus to the anterior abdominal wall by three permanent sutures, in the manner described in Chapter XXIX, Vol. II. The manifest advantages of this step have been insisted upon first by Dr. G. M. Edebohls and then by Dr. O. Küstner.

In bad cases a simple suspension is not enough to hold the uterus in the abdomen, and I have here tried with success the plan introduced by Dr. J. A. Sampson, of suturing the body of the uterus between the layers of the incision and the abdominal wall. The uterus is drawn out through the abdominal opening, and the peritoneum is closed above and below the cervix. The muscles and fasciæ are then united in such a manner as to intercalate the body of the uterus between them, not preventing the close union of the fasciæ over the dorsum of the uterus. The stitches which unite the opposite sides may also be made to pass through the posterior surface of the uterine body. The superficial fat and skin wounds are then completely closed.

Prolapse of the Uterus with Complete Rupture of the Recto-vaginal Septum.—Where the laceration is complete, tear of the recto-vaginal septum deviates markedly to one side or the other, the lateral fibers of the **levator ani** muscle may be ruptured as well, and prolapse occur. If the tear has extended above the sphincter area, there may be also a prolapse of the rectum. (See Fig. 361.) The treatment of this complex condition is similar to that just described, with the exception of the restoration of a ruptured instead of a relaxed vaginal septum in the manner described in Chapter XV.

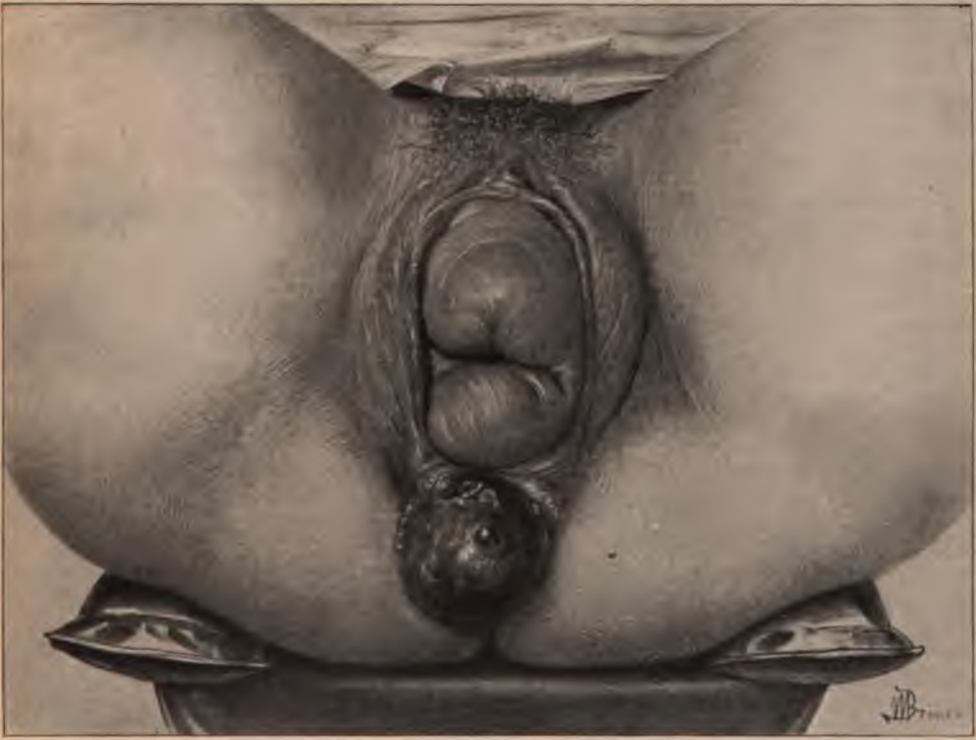

FIG. 361.—PROLAPSE OF THE UTERUS, VAGINA, AND RECTUM, WITH COMPLETE RUPTURE OF THE RECTO-VAGINAL SEPTUM. M. W., PHILADELPHIA.

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CHAPTER XXIII.

INVERSION OF THE UTERUS.

1. Definition and description (p. 634).
2. Various forms (p. 634): (*a*) Post-partum, acute and chronic. (*b*) Pathological, acute operative and chronic.
3. Etiology (p. 635): (*a*) Post-partum, spontaneous and traumatic. (*b*) Pathological.
4. Symptoms (p. 636): (*a*) Hemorrhage. (*b*) Shock. (*c*) Course of disease.
5. Diagnosis (p. 637).
6. Prognosis (p. 638).
7. Treatment (p. 639): (*a*) Manual reduction: 1. Central taxis. 2. Peripheral taxis. 3. Lateral taxis. 4. Taxis in relays. (*b*) By mechanical appliances. (Obsolete.) (*c*) Operative measures: 1. Operative dilatation of constriction. 2. Operative division of constricting ring. 3. Vaginal amputation of uterus.
8. Inversion due to malignant disease (p. 644).

Definition and Description.—The uterus, in inversion, is turned inside out so as to form a hollow tumor, projecting into the vagina. Its walls are, externally, the uterine mucosa; internally, the peritoneum; while between the two lies the muscular coat of the uterus. The uterine ends of the tubes and the utero-ovarian ligaments enter the funnel-shaped pouch formed by the inverted peritoneum, while the ovaries and the outer ends of the tubes lie just above it. (See Fig. 362.) The sac within is not more than 2 to 2.5 cm. (⅘ to 1 inch) deep, and its neck forms a narrow slit or puckered orifice opening into the peritoneum.

VARIOUS FORMS.

Inversion of the uterus can primarily be divided into two classes: Post-Partum, that is, those cases which occur immediately after labor, and Pathological, that is, those in which the lesion is due to some pathological condition of the uterine wall, which induces the inversion by virtue of its direct mechanical action.

Post-partum Inversion.—The amount of inversion occurring immediately after labor may vary greatly, and Vogel (*Zeit. f. Geb. u. Gyn.*, Bd. 42) mentions three degrees: Inversio Incompleta, in which there is a simple depression at the fundus; Inversio Completa, in which the organ is completely turned inside out, and the fundus lies at the level of the external os, or even down in the vagina; and finally Prolapsus Uteri Inversi, where there is a complete inversion and prolapse of the uterus and vagina, so that both organs lie between the thighs of the patient. In such cases the placenta has been observed attached to the inverted fundus (Bumm, " Grundriss zum Studium der Geburtshülfe," Wiesbaden, 1902).

The inversion is acute when it is observed immediately after labor, or chronic when the patient has survived the immediate effects of the acute stage. Between the acute and chronic there is a subacute stage, but this has not received much attention from writers upon the subject.

Pathological Inversion.—Inversion can be produced slowly in a non-puerperal uterus along with the expulsion of a tumor attached to its wall. This is the pathological variety and the form most frequently met with in gynecological clinics.

ETIOLOGY.

Statistics collected by Beckmann (*Zeit. f. Geb. u. Gyn.*, Bd. 31) and Vogel (*loc. cit.*) show that the puerperal form of inversion is more frequent in primiparous women and in those who are under thirty. These authors disagree, however, in the method by which the lesion is produced, Beckmann claiming from an analysis of 100 cases, that in the majority of instances the accident occurs spontaneously, while Vogel, in a similar review, holds that most cases are due to violence. As the majority of cases reported have occurred in private practice and frequently in the care of midwives, the idea of violence can not be disregarded. Any condition that favors relaxation of the musculature of the uterus and patulousness of the cervix will predispose to a uterine inversion. The exciting cause is usually some direct mechanical pressure, exerted from above by efforts of expulsion on the part of the patient, attempts at "Credé," etc., or even the pressure caused by the post-mortem development of gas in the abdominal cavity. Taylor and Kaltenbach (cited by Beckmann, *loc. cit.*).

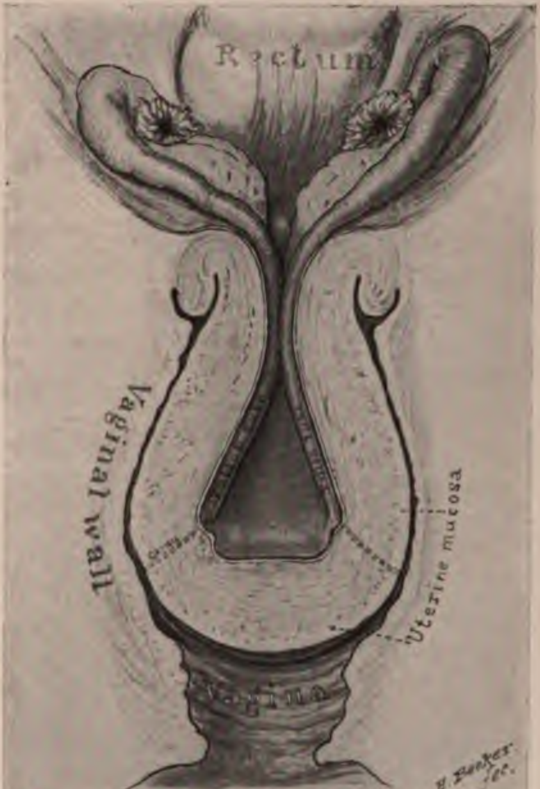

FIG. 362.—INVERSION OF THE UTERUS, SHOWING THE INVERTED UTERINE BODY FILLING THE UPPER VAGINA, AND THE CERVICAL RING THROUGH WHICH THE INVERSION HAS TAKEN PLACE.

The ovaries and the uterine tubes lie at the entrance to the inversion funnel.

The pressure may also come from below by traction upon an abnormally short cord or one which has been reduced in length by coils about the extremities of the child. Beckmann calls attention to the importance of the situation of the placenta as a predisposing factor, claiming that a centrally implanted one may predispose to inversion. Increased weight of the placenta, as in syphilis, infarcts, etc., has also been mentioned by these authors, and Rokitansky speaks of a paralysis or a failure to retract on the part of the placental site.

The commonest cause of pathological inversion is a submucous fibroid attached to the fundus of the uterus. The mechanism of the formation under these circumstances, is relaxation of the uterine cavity below the tumor, produced by expulsive efforts like those of labor, through which the tumor is finally forced into the vagina, dragging with it the attached portion of the uterine wall. If the tumor is submucous and becomes pedunculate, the peritoneal surface of the uterine wall may undergo no displacement, and there is no inversion. If, on the other hand, the tumor remains sessile as it descends, the whole thickness of the uterine wall and peritoneum may follow, creating on the peritoneal surface an indentation, at first slight, but becoming more and more deeply depressed, until complete inversion is brought about by the escape of the tumor into the vagina or out at the vulva, when we have the inversion with prolapse, above mentioned. The tumor causing the inversion need not arise from the fundus; it may be attached to a lateral wall. It sometimes happens that only part of the uterine wall is involved in the inversion, as in a specimen I saw in the collection of Professor Werth, of Kiel, where there was a little, inverted, peritoneal pit projecting into a pedunculate myoma, while the rest of the uterus appeared normal. It has been suggested that a partial inversion of this sort might be brought about artificially by traction upon the tumor at the time of operation. Such an occurrence is perfectly possible, but it was not the case in this instance, as was evident from the delicate bands of peritoneal adhesions stretching from side to side of the inverted sac, showing that it had existed for some time.

An inversion is sometimes found in which the tumor producing it has sloughed off. I had a case in which this mode of production was evident from the transverse linear scar about 3 cm. long, on the inverted fundus, with fine cicatricial lines radiating out from it in all directions. If the inversion is subacute or chronic, the neck of the inverted sac may become occluded by an adhesive inflammation, and the sac contain a quantity of clear serum which escapes into the peritoneal cavity on the reduction of the inversion.

SYMPTOMS.

The classical symptoms of acute post-partum inversion are hemorrhage and shock. The bleeding, as a rule, is profuse; occasionally, however, it is so insignificant as not to excite comment. Shock is always a prominent symptom and out of all proportion to the amount of blood lost. If the hemorrhage which occurs is not sufficient to cause death, and the inversion be unrecognized, the contraction at the cervical ring will, in a short while, become so marked as to check the bleeding to a great extent. The origin of the hemorrhage is of course the open mouths of the uterine sinuses, which bleed profusely. Occasionally the hemorrhage and collapse are so severe that death ensues a few hours after the accident.

The shock is invariably out of all proportion to the amount of blood lost, and occasionally it has been intense where there has been little or no hemorrhage. Vogel admits that this phenomenon is not easy to explain, and various theories have been suggested in regard to it. For instance, v. Winckel suggests that the causative factor is the bruising and tearing of the sympathetic fibers of the uterus; Martin, the compression of the peritoneum and adnexia in the inversion funnel; while Kehrer speaks of a "nervous anæmia." The nervous influence certainly has much to do with the collapse, but an entirely satisfactory explanation is wanting.

If the condition is recognized at once and the inverted uterus reduced without loss of time, the case will make an uninterrupted recovery, provided there is no infection. If, however, the inversion be not recognized, the patient may go into the chronic condition of the disease, provided of course that immediate death does not ensue; the result in all cases must depend largely upon her ability to resist the initial shock and infection.

An interesting but extremely serious complication has been noted by B. B. Browne (*Gyn. Trans.*, 1899, vol. xxiv, p. 249). His patient had been delivered by a midwife six days before he saw her. When he was called in, she had a complete inversion of the uterus, and was dying with the symptoms of strangulated hernia. The intestines could be felt in the inversion, and had probably been carried down at the time it occurred. An attempt to reinvert had to be abandoned on account of her condition, and she died in a few hours.

DIAGNOSIS.

The diagnosis of the acute post-partum variety of inversion should offer no difficulty. Nevertheless, the literature of the subject is replete with instances in which the tumor has been mistaken for a bleeding fibroid around which a ligature has been flung to check hemorrhage. The result of such a procedure can easily be imagined. Such an occurrence was reported by Gardiner (verbal communication), who in consultation found an inverted uterus which had been ligated several days before. It had become a gangrenous, stinking mass.

When at the close of a labor case, the patient suffers with a certain amount of hemorrhage and undue shock, an investigation of her uterus should always be made, and, if inversion has occurred, by bimanual examination the inverted fundus will be found filling the vagina as a round, somewhat compressible mass, which presents the characteristic "feel" of the uterine muscularis; the abdominal hand will notice the absence of the fundus uteri in its normal position, and the "inversion funnel" can always be felt, unless the abdominal walls are excessively thick.

In the chronic condition, the commonest symptom of inversion is hemorrhage, which occurs with great ease from the exposed mucosa; this hemorrhage will be found to date from the last labor and is stated to have been particularly severe immediately after it. The patient, when first seen, presents a high degree of anemia, and complains of a tumor which she and her physician may have mistaken for a cancer.

The examination in such a case had best be made under anesthesia, when a thorough investigation of all associated conditions can be effected. Diagnosis is easy if a red, bleeding, pyriform tumor, about 3 cm. in diameter, larger below and contracted above, is found filling the vagina. By bimanual palpation a depression is distinctly felt entering the tumor on its peritoneal surface, and the absence of the fundus in its normal position is demonstrated. When the inversion is complete, the cervix can not be distinguished at the vaginal vault, which seems to be continuous with the tumor. If the inversion is incomplete, the cervix remains as an enlarged ring, and the sound may be pushed into it for a short distance, up into the neck of the sac. The presence of the orifices of the uterine tubes at the lower end of the tumor is also a diagnostic point of considerable importance.

In the pathological variety of inversion, where there is a tumor projecting into the vagina with a partially inverted uterus, the uterine attachment of the tumor presents a depression which may be felt through the rectum; when the inversion is partial, any undertaking to enucleate in ignorance of this complication is most hazardous. The peritoneum has been opened under such circumstances, and the life of the patient lost through the tendencies of the uterine wall thus cut through, to retract out of sight, and to bleed into the peritoneal cavity. The difficulty of getting hold of the edges of the wound, together with the injury and exposure to the peritoneum, made such an accident one of the gravest which formerly could befall a gynecologist. The proper plan in the event of such an occurrence would be to open the abdomen immediately and deal with the bleeding area directly by suture. The rule, therefore, in every case of submucous myoma is to assume that an inversion does exist until the contrary is proved by palpating the peritoneal surface over the point of attachment of the tumor by a careful rectal and bimanual examination.

PROGNOSIS.

Inversion of the uterus in the acute variety is an exceedingly serious condition. Much depends on the early recognition of the accident, for, if immediate attempts be made to reduce the inverted fundus, they will be successful in the large majority of cases. An illustrative case is one observed with Dr. Wm. F. Lockwood. The patient was a primipara with pulmonary tuberculosis; after forceps delivery and expression of the placenta by "Credé," there was some hemorrhage and almost absolute collapse. On vaginal examination a complete inversion of the uterus was noted, and the ease with which it was reduced by central taxis was remarkable. She made an uneventful recovery.

In the series of cases reported by Beckmann (*loc. cit.*) the total mortality of 14 per cent is given. Kehrer says 25 per cent, but Crosse collected 109 cases, in which 80 patients died a few hours after delivery.

In the chronic variety the prognosis is unfavorable if the case be left alone. Very few cases undergo spontaneous reposition. The hemorrhage endangers life, and the ulceration of the exposed surface may give rise to sepsis. In one instance reported, there was a spontaneous amputation of the body of the uterus.

TREATMENT.

The methods by which an inversion of the uterus can be treated may be divided into three classes: (1) Taxis, (2) Mechanical Appliances, and (3) Operative Procedures. Treatment by mechanical appliances, such as pessaries, water bags, etc., is, in the present light of abdominal surgery, out of date, and, hence, will not be mentioned. The line of treatment chosen will, of course, vary with the particular factors of the case.

MANUAL REDUCTION.

In the acute post-partum inversion, by far the best method of treatment is manual reduction by taxis. Attention has already been called to the fact that if taxis be instituted immediately, it will be successful in the majority of cases. It may be practiced in several ways:

Central taxis, in which the most prominent portion of the tumor is attacked with the conated hand and pushed directly in upon itself until the organ is returned to its normal position, is successful in most recent cases where the constriction at the cervical ring has not become marked.

Peripheral Taxis.—Here the hand grasps the fundus of the uterus, and after some compression, to reduce any edema that may be present, an attempt is made to return through the cervical ring that portion of the uterus which last came down.

Lateral taxis, commonly known as Noeggerath's plan, is that in which first one side of the uterus and then the other is attacked, the idea being to push it back horn by horn.

Prolonged taxis by several operators in relays has been tried successfully, but is mentioned here only to be condemned.

When taxis is attempted, the patient should always be under an anesthetic, and with the whole hand in the vagina, the operator should first make pressure upon the center of the tumor, assisting himself by counter-pressure with the free hand, which tries to dilate the constricted opening through the abdominal wall. If this is not successful, the tumor should be taken in the palm of the hand and the fingers passed up in the groove that lies just above the cervix. After some compression to reduce edema, the hand attempts to push the marginal portions of the uterus through the ring, again using the external hand for counter-pressure and general assistance. As has been already mentioned, if the case be seen early, there is often little or no difficulty in reducing the inversion. The tendency for it to recur, however, is quite common, and should be counteracted by the introduction of an iodoform gauze pack filling both uterus and vagina. This pack can be removed the following day.

If an acute inversion is produced during the enucleation of a submucous tumor attached to the fundus it will usually be sufficient to take away the tumor to bring about a complete return of the uterus to its normal shape. On account of the facility with which reposition occurs under these circumstances, it is important to pass all of the sutures to close the wound and stop the bleeding before finally detaching the tumor, otherwise the bleeding surface once reinverted can not be reached.

In chronic cases one of the following three methods of treatment may be adopted:

1. Manual efforts at reduction, before described.
2. Some surgical procedure which has as its object dilatation or incision of the constricting ring, thus permitting reposition.
3. Vaginal amputation of the uterus.

MECHANICAL APPLIANCES.

Manual efforts at reduction should always be tried first and the various methods of taxis already mentioned, gone through. If the uterus has been down for any length of time the difficulties of this method of treatment are almost insuperable, arising from the rigid fibrous character of the uterine tissue with vascular engorgement and edema, as well as the fact that the rigid neck of the inverted peritoneal sac is much smaller than the body of the uterus which has passed through it. These obstacles are responsible for the invention of many ingenious mechanical devices, such as pessaries, hydrostatic bags, etc., which were in use by our predecessors.

Prolonged forcible attempts at manual reposition are not justifiable, on account of the inevitable bruising of the tissues and the danger of lacerating the cervix. Martin ("Path. und Therap. der Frauenkrankheiten," 3d ed., Wien und Leipzig, 1893, p. 158) reports a case in which the wall of the uterus, which had been down six years and had become fatty, perforated, the patient dying of collapse in the course of a few days.

OPERATIVE MEASURES.

The second plan of treatment, that of **surgically dilating or dividing the constriction, and then replacing the fundus**, is a procedure that can be resorted to in the event of failure of efforts at manual reduction. Operations of this class are of two kinds: (a) The inversion funnel is exposed and manually or instrumentally dilated; (b) after exposing the inversion funnel, the constricting bands of uterine tissue are divided. Of course, in each of these procedures reinversion is immediately accomplished.

It would seem an easy thing, upon the failure of manual efforts at reduction, to open the abdomen, dilate the constricted canal from within by fingers or dilators, and then push up the uterus from the vaginal side through the enlarged canal into its normal position; but, although the plan has been tried, it has not been very successful. I note a failure of my own in a case of long standing inversion with prolapse, in Philadelphia, sixteen years ago. The proposed plan was to open the abdomen, expose the neck of the inverted sac, stretch this with strong dilators, and then, with the help of an assistant, force the body of the uterus up through the enlarged neck of the sac, producing reposition. I further intended to prevent the recurrence of the inversion and prolapse by stitching the fundus to the anterior abdominal wall (Suspension of the Uterus, Chap. XXIX, Vol. II).

I opened the abdomen and exposed the narrow slit-like orifice at the site of the inversion, but my utmost efforts to make any impression upon the opening with fingers or dilators were unavailing, and I was obliged to abandon the attempt and relieve the patient by amputating the uterus through the vagina.

On the other hand, a successful operation of this kind was performed by Dr. T. G. Thomas, of New York, in September, 1869 (*Amer. Jour. of Obst.*, vol. ii, p. 423). The patient was put under ether, after which an assistant lifted the uterus up against the abdominal wall with such force that the intestines were displaced and the cervical ring could be felt. A small incision was then made in the median line of the abdominal wall down to the ring, opening the peritoneum. The operator now grasped the inverted uterus in the vagina, and at the same time introduced a powerful steel dilator into the neck of the sac on the peritoneal surface. The dilatation proceeded easily and rapidly, and the uterus was reinverted and restored to its normal form in twenty-seven minutes. The patient recovered and left her bed on the eighth day.

Browne (*loc. cit.*), in 1883, in a case of chronic inversion, which had resisted repeated and prolonged attempts at reduction, dragged the inverted fundus down until the orifices of both uterine tubes were brought plainly into view; he then made a longitudinal incision in the posterior portion of the uterine wall (avoiding the uterine tubes and other vessels at the sides of the uterus). Through this incision a large Sims dilator was passed up into the constricted cervix and expanded to its fullest extent. The rigid tissues of the cervix were felt to relax and the Sims instrument was replaced by Nos. 2 and 3 of Hanks hard rubber dilators. The wound was now sutured, and with slight manipulation the fundus was easily replaced. The patient made an uneventful recovery.

As examples of operations which have for their object incision of the constricting band of tissues, may be mentioned that of O. Küstner, and one recently done by one of my former associates, Dr. G. W. Dobbin.

Küstner's method (*Centralbl. f. Gyn.*, 1893, No. 41) of reposition in chronic cases resisting simpler methods of reduction, is in accord with recent developments of gynecological surgery, and promises success in cases which it had hitherto been found impossible to treat in a conservative way. The steps of his operation are conducted in the following manner:

First, a wide transverse incision in Douglas' *cul-de-sac*, opening the peritoneum.

Second, the introduction of the index finger through this opening into the inversion funnel of the uterus, and separation of any adhesions found.

Third, a longitudinal incision through the posterior wall, as nearly as possible in the median line. It should begin about 2 cm. below the inverted fundus and end about 2 cm. above the os externum, extending all the way down to the peritoneum.

Fourth, reinversion of the uterus by fixing the funnel with the index finger in Douglas' pouch, and pressing in the fundus with the thumb of the same hand.

Fifth, suture of the uterine incision by deep and superficial sutures passed on the peritoneal surface.

Sixth, closure of Douglas' *cul-de-sac* with sutures.

Dobbin's operation was done on a patient with a complete post partum inversion, seen about five days after labor, and badly infected at the time. After ineffectual efforts at manual reduction, the abdomen was opened, with a view to dilating the constricting ring from above, as was done by Thomas. This attempt, however, failed absolutely. A longitudinal incision was then made in the anterior margin of the funnel, and carried directly through the wall until the inverted cavity was reached (see Fig. 363). The uterus could now be easily reinverted, and the incision in its wall, which was 12 cm. long, had the appearance of the incision in the typical Cæsarean section (see Fig. 364). It was sutured immediately as in that operation and the abdomen closed. The patient died several days later from the infection present before she came under observation.

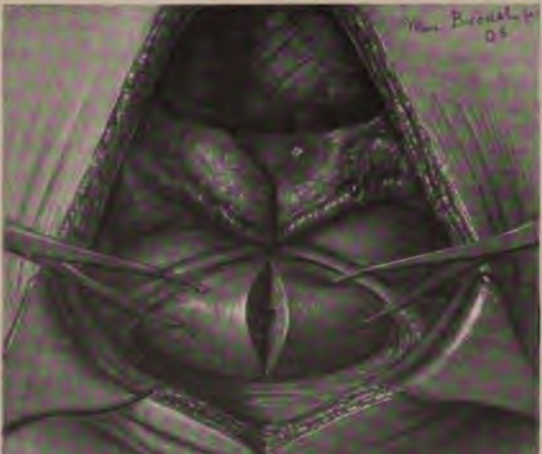

FIG. 363.—INVERTED UTERUS WHICH COULD NOT BE REDUCED BY MANIPULATION.

Picture shows abdominal cavity opened and incision in uterus indicated, which is required to reduce inversion.

If manual efforts at reduction fail, and the infection present makes the operator think it unwise to risk soiling the peritoneum by one of the above-mentioned procedures, it is more conservative to make no attempt to save the uterus, but immediately to resort to the third procedure, namely, vaginal amputation.

Vaginal Amputation of the Uterus.—After a thorough cleansing of the field, the uterus is enveloped in sterilized gauze, grasped, and drawn down; it is then exposed by pulling back the posterior vaginal wall with a speculum, so that the neck of the sac at the vaginal vault is accessible. The amputation is now begun by cutting two flaps at the neck of the inverted uterus, one anterior and one posterior, just below the vault of the vagina. Before the peritoneum is opened, three or four stout silk ligatures are passed with a large curved needle completely through the uterine stump in an antero-posterior direction.

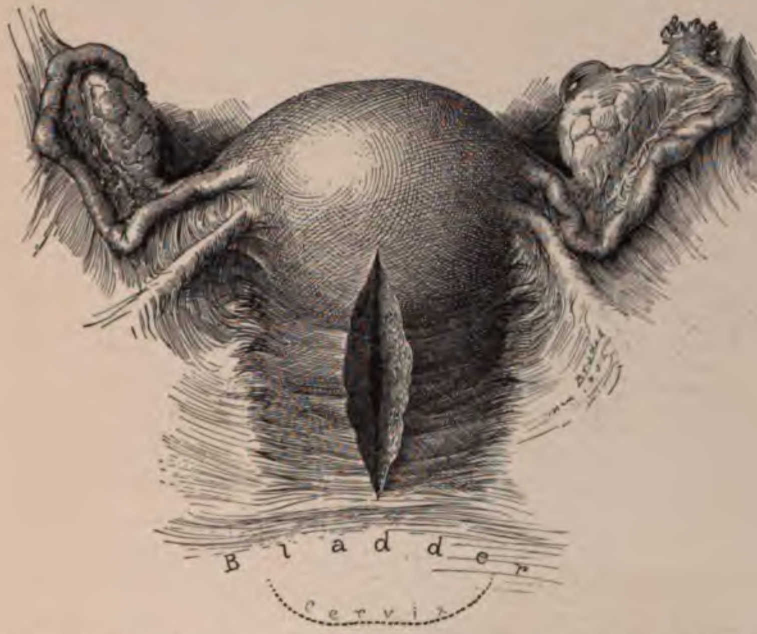

FIG. 364.—THE UTERUS AFTER INVERSION HAS BEEN REDUCED, SHOWING LONG INCISION IN THE UTERUS MADE THROUGH ABDOMINAL WALL.

The peritoneum is now cut through in front, and by continuing the incision cautiously up to the sides, the uterine arteries and veins are found, clamped, and tied with fine silk as high up as possible. An assistant maintains a strong traction on the ligatures to keep the stump from inverting into the peritoneum. The operator now takes the ligatures one at a time and ties them tightly, bringing the lips of the stump firmly together. Additional deep sutures must be passed, if necessary, to check bleeding and secure accurate approximation. The stump closed in this way soon slips through the cervix and a partial reinversion is established.

The most important point to bear in mind throughout, is that the ligatures passing through the stump must keep the lips of the wedge-shaped incision firmly approximated, even after reinversion has occurred. A dry dressing should be kept in the vagina; the sutures may be removed in ten days or two weeks.

Complete vaginal hysterectomy (panhysterectomy) may be performed by opening Douglas' pouch from side to side and the vesico-uterine pouch in front, and then hooking the index finger around one side of the cervix and passing a succession of ligatures through the tissue intervening between the finger and the vault, tying each ligature, and cutting between it and the cervix, taking care not to cut too near the ligature. The amount of tissue severed is small and the uterine artery is soon ligated; an additional ligature must be applied to its free end.

The opposite side is ligated in like manner, and the uterus freed. The bladder does not enter the inversion sac. If there is no bleeding, the peritoneal surfaces of the wound may now be drawn together with a running suture, the ligatures arranged on the right and the left side, and the vault of the vagina packed with iodoform gauze.

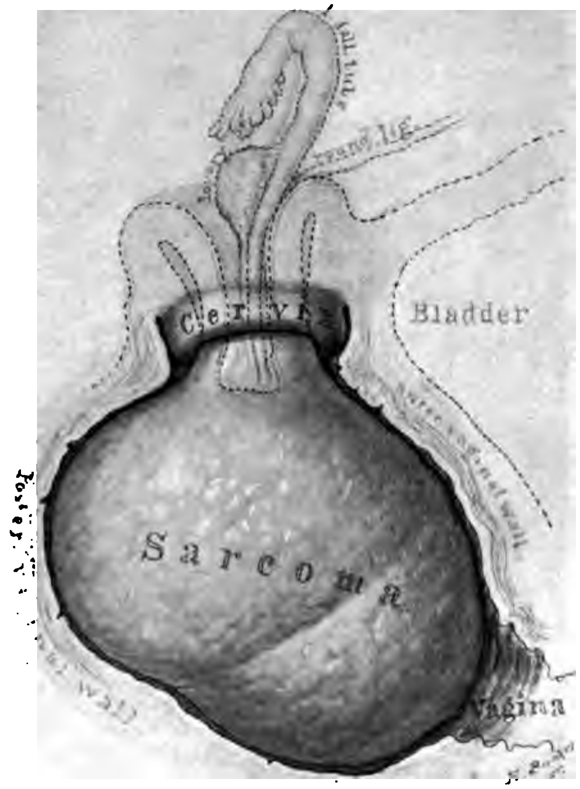

FIG. 365.—INVERSION OF THE UTERUS DUE TO SARCOMA. Hysterectomy, recovery. San., JAN. 19, 1897.

Inversion Due to Malignant Disease. — Inversion due to a malignant tumor of the fundus is rare, and I have seen but one case. The patient (J. H. B., San., No. 410, Jan. 19, 1897) presented herself on account of a fetid, watery, blood-tinged discharge which had continued for about a year, with hemorrhages at intervals.

I found the whole vagina above the levator ani filled with an ovoid mass about 8 by 6 by 4 cm., flattened antero-posteriorly, and attached at the cervix by a pedicle 2.5 cm. in diameter. The external os formed a sharp ring around the pedicle, and the depth of the canal was from 2 to 2.5 cm. (see Fig. 365).

Bimanually the uterine body was found absent, and in its place was a pit, which entered the cervical ring, close to which both ovaries could be felt, the left one entering it for a short distance. The ovoid body filling the vagina was made up of the inverted uterine body and a sessile tumor of a light grayish color covered with little tags of tissue.

In grasping this sessile mass it broke down, and was so friable that the entire enucleation had to be done with the fingers. There was no capsule at all, and no line of demarcation between the mass and the uterine tissue at its base, which covered an area of 2.5 by 2 cm. where the uterus appeared white and non-vascular. After seventy-two hours the fundus went up through the cervix, upon releasing a pair of forceps which had detained it, so as to obviate the risk of hemorrhage, that could not be controlled by suture in the friable tissue.

The tumor removed was broken up into a number of irregular pieces, and was easily penetrated by the fingers in all directions, without any hard or resisting nodules; the tissue toward its base had an edematous appearance and was longitudinally striate and tore in shreds, like the meat of a crab's claw. A microscopic examination showed that the tumor was a spindle-celled sarcoma. A complete abdominal hysterectomy was therefore done a week later, after which the patient recovered.

CHAPTER XXIV.

VAGINAL EXTIRPATION OF SUBMUCOUS MYOMATA AND POLYPI.

1. Description and position of myomata (p. 646).
2. Symptoms (p. 647): *a*. Hemorrhage. *b*. Pain. *c*. Suppuration.
3. Diagnosis (p. 649): *a*. History. *b*. Palpation. *c*. Difference between fibroid polyp and cancer.
4. Treatment—extirpation (p. 650): *a*. Selection of cases. *b*. Cutting through the pedicle. *c*. Removal of sessile submucous fibroids: (1) Piecemeal, with forceps and scissors; (2) by splitting the capsule; (3) by both these methods combined; (4) by celiotomy.
5. Complications (p. 654): *a*. Hemorrhage. *b*. Sepsis. *c*. Rupture of uterus. *d*. Death from exhaustion.
6. Polypi (p. 656).

Description and Position of Submucous Myomata.—Quite often a myomatous tumor, originating in the submucosa or, interstitially, in the uterus, is carried, in the course of its development, down into the uterine cavity, where it is found attached by a broad base or by a pedicle of varying length. The tendency to develop in this way is greatest where there is a single tumor, which may vary from the size of an egg to that of a mass big enough to choke the pelvis. Small submucous myomata are also occasionally found associated with large interstitial and subserous tumors. The tumor, which lies at first concealed in the uterine cavity, may, in the course of time, be extruded through the plastic cervix until it comes to lie partly or wholly within the vagina, or even outside the vulva, where it may be found associated with an inverted uterus or with a long, slender pedicle. Large, sessile tumors are sometimes grasped so firmly by the cervix, when only partially delivered out of the cavity of the uterine body or into the vagina, as to show a deep encircling furrow at the point of constriction at the internal or external os. The pedicle of such a tumor may be attached to any part of the uretus from fundus to cervix. The most usual position is an attachment to the body just above the cervix.

The submucous myoma in the early stages is covered by the mucosa, which gradually becomes thinner, and not infrequently entirely disappears in places. This atrophy is due to pressure and attrition. The uterine mucosa between two adjacent submucous myomata is frequently thickened because it is protected from pressure. Apart from these inequalities in the thickness of the mucosa it is usually unaltered. Occasionally, however, the mouths of the glands become occluded, and small cysts develop; in one of my cases the uterine cavity was studded with clear lenticular cysts, some of which were 8 mm. in diameter. The presence of submucous myomata does not preclude the possibility of endometritis or tuberculosis, or of other changes in the mucosa, such as carcinoma and sarcoma. Cysts found in the middle of such tumors lined with cylindrical ciliated epithelium have been explained as originating in a portion of the glandular tissue nipped off early in the development of the tumor. Occasionally submucous tumors are multiple (see Fig. 371), but this is a rare condition.

Symptoms.—The most characteristic symptoms are hemorrhage and pain. The hemorrhages are often excessive, and make the woman extremely anemic. They are worse at the menstrual periods, but may last for weeks or months together. The pains arise from the expulsive efforts of the uterus trying to push the foreign body without the cervix; they are severe, intermittent, and expulsive in character, like those of labor; they often continue for years. Occasionally cases are observed where the pain has been slight, or absent altogether, and the only symptom is hemorrhage. A thin serous oozing from the mucous surface, resembling that of early cancer, may be the first symptom to call the woman's attention to her condition.

Most myomata are interstitial in their beginning, and only become subserous or submucous as they grow, the direction of their growth depending upon their situation and the resistance encountered.

The myomatous tumor takes its origin in a little muscular whorl which is poorly vascularized, its blood supply coming from the capillaries of its periphery, which send their branches into the tumor along its connective tissue septa. As the tumor increases in size the vessels are thickly crowded together around its periphery, and as it becomes submucous it pushes down toward the uterine cavity and begins to infringe upon the mucosa. The latter is crowded upon the opposite wall, and thins out until it loses its normal characteristics and the vessels are exposed; then hemorrhage occurs. At first there is but slight increase in the length and quantity of the menstrual flow from the erosion of the mucosa. A real hemorrhage first takes place when the mucosa becomes so thin that the underlying leashes of vessels belonging to the tumor itself are infringed upon. Then a large vessel may rupture, or many smaller ones, simultaneously, during the menstrual congestion. The vessels form a deeply injected corona around the projecting myoma at its periphery, and the hemorrhage is largely from this area, after the most prominent portion of the tumor has been thinned down to its non-vascular area. In the advanced stages of the submucous tumors the freest hemorrhage is therefore on the border line between the thicker mucosa and the attenuated envelope of the tumor. As a rule, these submucous tumors produce a corresponding cup-shaped depression on the opposite uterine wall, and in the depression formed by the projecting tumor the same vascular phenomena are found. I have made these deductions from a careful study of this subject by Dr. J. G. Clark.

Often, when a total extirpation of the uterus has been made for multiple myomata, all the symptoms have really been due to a small submucous tumor projecting into the uterine cavity and causing the hemorrhage. If such a tumor is removed by a thorough curettage, little or no further trouble may be experienced unless another tumor pushes down under the mucosa.

A small pedunculate tumor may descend into the vagina with each menstrual period and return into the uterus afterward, in this way appearing intermittently. A large tumor choking the pelvis often gives rise to serious pressure symptoms on the part of the bladder and rectum. The pedicles of small tumors may in time become so attenuated as to break, allowing the tumor to escape spontaneously. Larger masses sometimes become necrotic, and break down into a fetid, gangrenous, suppurating mass, which extends up into the center of the tumor like a wedge, producing fever and cachexia with profound exhaustion. Several of the worst septic cases I have ever seen have been of this kind. In one the tumor had disappeared, and left behind only its muscular and mucous covering, which hung limp out of the cervix (see Fig. 366).

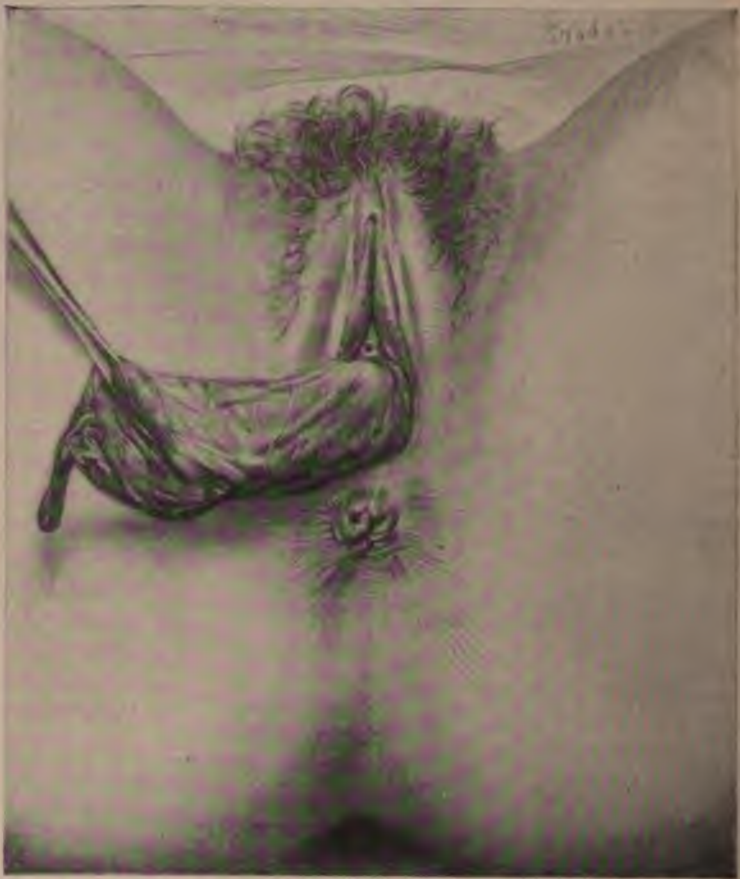

FIG. 366.—PEDUNCULATE SUBMUCOUS MYOMA BROKEN DOWN AND COLLAPSED.
The sloughing mass of tissue hanging out of the vulva is soft and flaccid, like a wet rag.

Injection of the blood vessels of myomata of the uterus clearly explains why sloughing and necrosis of the submucous tumors occur, for their internal blood supply is almost invariably poor, and frequently even before they reach the mucous or serous surfaces a necrotic or calcareous core is found. If the tumor becomes submucous, and the wreath of vessels and the mucosa are eroded away, either sloughing from a necrobiosis or suppuration from infection may occur.

Diagnosis.—The diagnosis is made from the history of intense menstrual pains and excessive flow, and by a direct examination which reveals the presence of a rounded tumor in the vagina or just inside the cervix. By passing the finger around it on all sides, the tumor is found to be smooth and to have a pedicle within the uterus; if the tumor is still retained within the uterine cavity, its pedicle may be demonstrated by passing the sound around on all sides. A differential diagnosis must be made between the myoma, of which we speak, and the uterus inverted, either whole or in part. This can only be done by careful palpation of the peritoneal surface of the uterus by abdomen and rectum bimanually, when, if there is any inversion, the corresponding depression on the peritoneal surface will be felt. If a satisfactory examination has not been made, it must be repeated with the patient anesthetized. A mistake may be made in diagnosis by confusing submucous myoma with a cancerous cervix. I have several times had polypi brought to me with the diagnosis of cancer. This error is the more pardonable when the patient has frequent hemorrhages and acquires a somewhat cachectic look, and where there is a sloughing of the myoma with frequent discharges. This will be avoided by

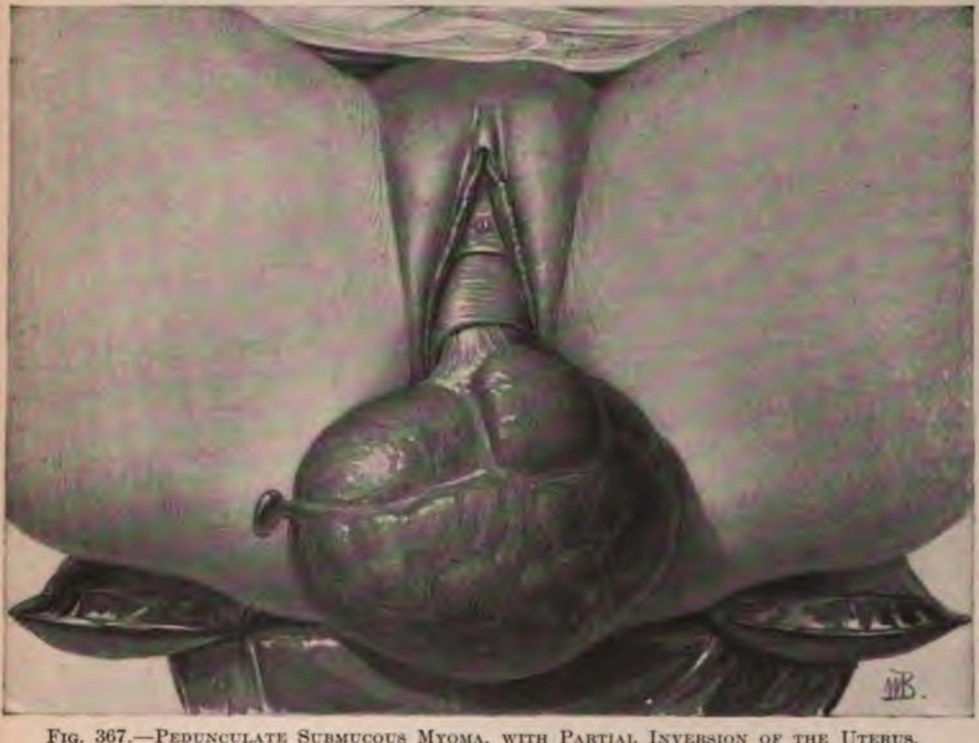

FIG. 367.—PEDUNCULATE SUBMUCOUS MYOMA, WITH PARTIAL INVERSION OF THE UTERUS.

observing the density of the myoma in contrast with the friable cancer. The smaller myomata are quite smooth on the surface; the larger only are nodulated. The myoma presents a distinct, well-rounded tumor, contracted above a pedicle which enters a canal; the cancer is a tumor whose broad attachment is not within the uterus but to the cervix, and often to one lip. It has a peculiarly friable hardness, and when advanced tends to infiltrate laterally.

The differentiation between a small submucous myoma which can not be seen or felt, and a cancer of the body of the uterus, may be extremely difficult to make from the clinical history and examination. By splitting the cervix up on both sides, and so opening the uterine cavity, the myoma may be readily seen and felt, but this will not be necessary if the endometrium is curetted and examined microscopically, when the characteristic changes are always found in cancerous cases. The same difficulty may be experienced in differentiating a myoma from a small sarcoma. I have dwelt fully on the microscopic signs of malignant tumors in Chapters XXXVII and XXXVIII, Vol. II.

A myoma still within the cervix has a characteristic feel, just like a smooth ball in a cup, and it may sometimes be rotated, showing that it has a narrow pedicle above.

A myoma sessile within the uterus will be diagnosed without difficulty, if the cervical canal is large enough to admit the index finger, which is introduced and palpates the convex surface of the tumor, while the uterus is held down by a pair of bullet forceps grasping the anterior lip of the cervix; or, if necessary, by using the other hand in making counter-pressure through the abdominal walls.

A sound may be employed in the uterus in the same way, when the canal is too small to admit the finger. By noting the increased depth of the uterine cavity and tracing its irregular form with the sound moving about within it, and by palpating *per rectum* and *per abdomen* at the same time, an accurate idea is gained of the size and location of the tumor.

Treatment.—The treatment of a submucous myoma is by extirpation. The method will vary according as it has or has not a pedicle, and according to the site and the size of the tumor. It may be either by the vagina or by the abdomen.

In determining whether or not to operate by the vagina, there should be no hesitation in attacking pedunculate tumors and those which are sloughing by this avenue. It is sometimes necessary to remove by the vagina large submucous fibroids which are sloughing or causing profuse hemorrhages, even when the uterus contains many other interstitial and subserous tumors as well. The immediate indications under these circumstances are fully met by such a palliative procedure, which relieves the dangers to life and health; it is then left for the patient to regain sufficient health and strength to undergo a further abdominal operation if needed.

Suppurative disease of the appendages is a contra-indication to the vaginal extirpation of sessile myomata, as the manipulation of the uterus may originate an attack of peritonitis; in the experience of Freund, a pyosalpinx ruptured in this way was the cause of a fatal peritonitis.

If the uterus is of great size and the patient is suffering from the pressure, it is better to remove the whole mass at once by the abdomen. In cases of sessile myoma in women who are near or beyond the menopause it is better to do an abdominal hysterectomy than to risk a difficult vaginal enucleation of the tumor alone.

When the pedicle is long and attenuated, from 1 to ½ a cm., and can be easily reached in the vagina, it may be simply ligated 2 or 3 cm. from the tumor, divided with scalpel or scissors close to the tumor, and a dry dressing placed in the vagina. An attenuated pedicle which can just be reached within the uterus may be safely treated by torsion as recommended by Montgomery, grasping the tumor with Museux forceps and slowly turning it until the pedicle breaks off. I have also followed the plan of clamping the pedicle within the uterus with an ordinary pair of artery forceps and then cutting the tumor away and leaving the forceps *in situ* in the midst of a gauze pack for forty-eight hours; after this there is no more danger from hemorrhage, and they are removed.

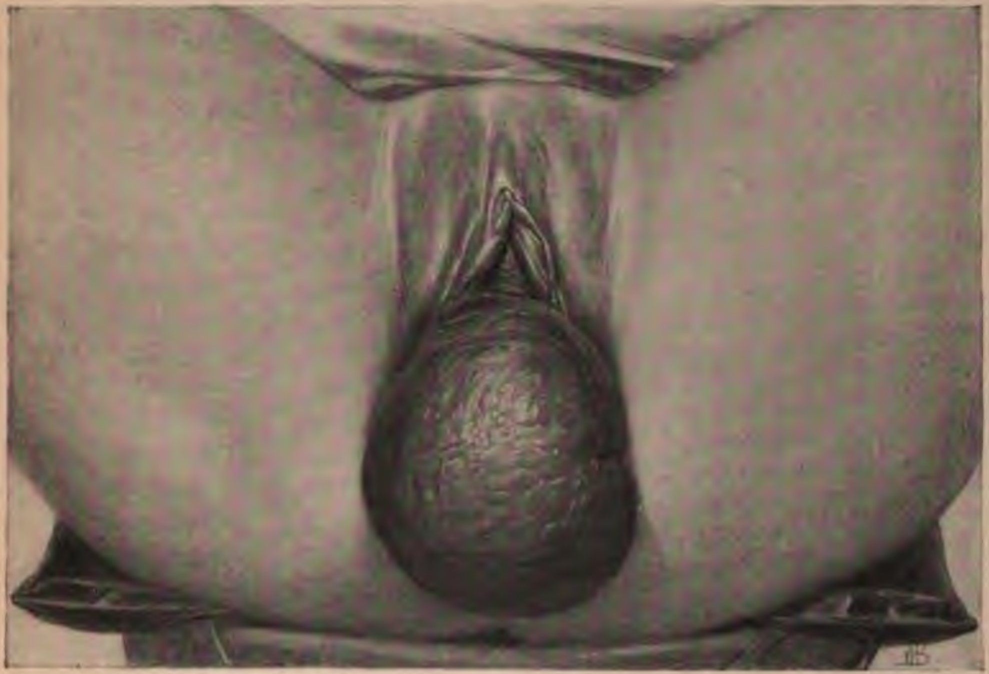

FIG. 368.—LARGE PEDUNCULATE SUBMUCOUS MYOMA HANGING OUTSIDE THE VULVA.

A stout pedicle, 2 cm. or more in diameter, may be grasped with bullet forceps, or held by passing two or three sutures through it near the tumor to prevent retraction when the tumor is removed, and then cut through in such a way as to make anterior and posterior flaps, taking care to do the cutting on the convex surface of the growth. After removal of the tumor the sutures are tied, bringing the flaps together to control bleeding. By observing the principle of effecting the separation on the surface of the tumor, instead of following the natural inclination, which is to amputate the pedicle as high up as it can be reached, the danger of cutting the uterine wall and opening a partially inverted peritoneum is obviated. When the tumor is so large as to fill the vagina, preventing easy access to its pedicle, it is a good plan to seize it with a pair of obstetric forceps and bring it outside, using the forceps as in delivery of a child's head when it has reached the pelvic floor. But if the woman is unmarried or has not borne a child, the attempt to drag a large tumor through the outlet will cause an extensive rupture. I saw a case of this kind in an unmarried woman with Dr. A. K. Minich, of Philadelphia, in 1883, where the tumor was about 6 cm. in diameter, and it was necessary to suture the perineum after delivering the tumor.

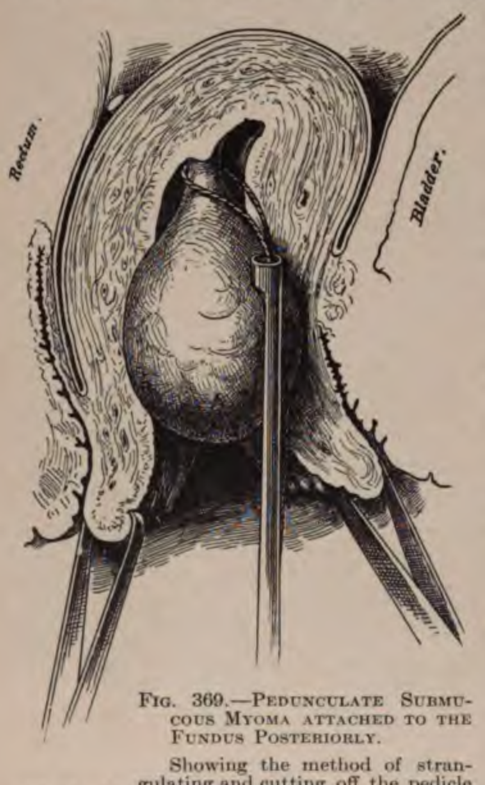

FIG. 369.—PEDUNCULATE SUBMUCOUS MYOMA ATTACHED TO THE FUNDUS POSTERIORLY.

Showing the method of strangulating and cutting off the pedicle with the écraseur after splitting the cervix and holding its lips apart to expose the tumor.

In such cases it is better to make a clean cut through the hymen down beside the rectum, to remove the tumor, and then to close the cut again. The écraseur is valuable for removing those pedunculate tumors lying within the uterus where the pedicle can not be reached in any other way. The tumor is grasped and fixed with Museux forceps, while a loop of strong twisted piano wire attached to the écraseur is slipped over the forceps and up over the tumor on to its pedicle. The loop is then rapidly reduced to the size of the pedicle, after which the screw is slowly turned, until the pedicle is cut through. It may be necessary in such a case to divide the vaginal cervix on both sides in order to expose the tumor before it can be grasped and removed with the écraseur (see Fig. 369).

Sessile submucous fibroids may be attacked in a variety of ways: by removing them piecemeal with forceps and scissors, or by enucleating them entire by splitting the capsule, or by both methods combined; if the tumor is entirely within the uterus and as large as a child's head, it will be more easily removed by an abdominal incision. The last plan was adopted by Dr. A. Martin, of Berlin, in an operation which I saw, and which is described by Dr.

W. Nagel in the *Centralblatt für Gynäkologie,* July 31, 1886, under the title "Exstirpation eines grossen polypösen Myom des Corpus Uteri durch Laparotomie." The tumor measured 16 by 12 by 9 cm.

When a portion of the tumor projects from the uterus, or the cervix is sufficiently dilated to allow it, it may be removed piecemeal (morcellation) by grasping the presenting part firmly with the Museux forceps and cutting boldly in beside the forceps with knife or stout scissors, removing as large a wedge-shaped piece as possible; the part adjacent to this is then caught and pulled more into view and attacked in the same manner. After several such wedges have been removed, the cutting may be continued more deeply into the tumor, when the sides will collapse, allowing the remainder to be easily shelled out or cut away. If the tumor is covered by a capsule, it is best to incise this broadly and strip it back before attacking the tumor itself. The latter part of the enucleation may often be easily completed by the fingers, but it is safest to stick to the instruments, and to strip the tumor out of its base with blunt scissors, sound, or spatula, while keeping up the traction with the forceps.

When the tumor is so dense that the scissors make but little impression on it, the enucleation may be more rapidly effected by cutting out wedges with a sharp sickle-shaped knife, like that shown in Fig. 370; this has the advantage of burying itself deeply in the tissues and cutting as it is drawn toward the operator.

In order to expose a tumor which can not be reached through an undilated cervix, the vaginal vault is exposed by retractors, and the anterior and posterior cervical lips caught and held apart with tenaculum forceps, while a deep incision is made on each side, splitting the entire cervix up into the uterine cavity. This lays bare the tumor, which is carefully explored with the finger or a sound to determine its size or location. If it is interstitial the capsule is split from end to end and worked back with a blunt instrument on all sides, so as to expose as much as possible of the fibroid mass beneath. The most accessible portion is now grasped with stout Museux forceps and forcibly drawn down, while a wedge-shaped segment is removed with knife or scissors. In this way piece after piece is extracted, until the tumor has been sufficiently diminished in size for the rest to be withdrawn through the cervix.

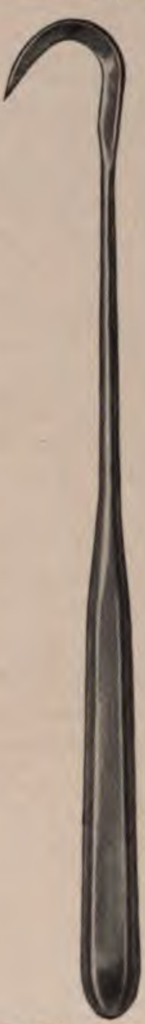

FIG. 370.—SICKLE-SHAPED STOUT KNIFE USED IN EXTIRPATING LARGE SUBMUCOUS MYOMATA.

Hemorrhage is, as a rule, only moderate, and occurs at once after the extirpation. The reason why profuse hemorrhage rarely occurs after these operations can be well demonstrated by the injected specimens, which show that there is no large artery present; moreover as soon as the tumor is removed the contraction of the uterine muscle acts as an efficient hemostatic.

At the completion of the operation the uterus is thoroughly washed out with warm water, the incisions in the cervical lips closed with silkworm gut sutures, and the vagina packed with iodoform gauze.

If a sloughing fibroid has been extracted, it is best not to try to unite the cervical lips, but to pack the uterus with gauze, to be removed in two or three days and followed by daily irrigation.

The plan of splitting the capsule and enucleating the tumor with a blunt instrument is also well adapted to large sessile cervical fibroids. In a case (C. V. B., J. H. H., No. 3295) upon which I operated Jan. 30, 1895, the anterior cervical lip was occupied by a large dense fibroid tumor choking the entire vagina; the posterior lip was high up in the pelvis and intact. The tumor was sessile, with a base of attachment extending from a point half-way down the anterior vaginal wall to a point high up on the uterus.

A sagittal incision 6 cm. (2½ inches) long was made over the most prominent portion, through the vaginal capsule, which was half a centimeter thick; the sides of this incision were then peeled back, to right and to left, and the exposed, white, nodular fibrous surface grasped with forceps and pulled upon, while the enucleation was continued with a blunt instrument, peeling the tumor out of its fibrous investment, which extended above the vault of the vagina up under the bladder as high as the internal os uteri. There was a little bleeding from the bottom of the large hole made in the vaginal vault, which was easily controlled by a continuous buried catgut suture, approximating the sides and diminishing the size of the cavity. The external incision appeared collapsed and irregular and could not be neatly approximated in one line, so I brought it together by a single silkworm gut, purse-string suture. A dry dressing was applied and an uneventful recovery ensued, without suppuration.

Complications.—The following complications may occur in consequence of these operations: Hemorrhage, sepsis, rupture of the uterus, and death from exhaustion.

Hemorrhage is usually moderate, and if the bleeding area can not be seen and controlled by ligature, the flow may be checked by a firm pack of wool or sterilized non-absorbent cotton left in the uterus from twenty-four to thirty-six hours.

I have in four instances, after the removal of a fibroid tumor attached to the fundus, encountered a hemorrhage which was persistent, in spite of the adoption of all ordinary means to control it. The first case was in Philadelphia, Feb. 3, 1889. The patient (M. R.), already almost exsanguine from the constant flow from the pedunculate fibroid, bled so fast after the removal of the tumor that I feared she would die at once. I therefore packed the uterus with gauze and completely closed the vaginal cervix with silkworm gut mattress sutures, passed through both lips and tied tightly. This stopped the flow, and in forty-eight hours I cut the sutures and removed the pack.

I have done the same thing since then in three similar cases in the Johns Hopkins Hospital with a like result. There were no symptoms after this closure pointing either to the damming up of blood in the uterus or to its escape out through the uterine tubes onto the peritoneum in any of the cases.

Sepsis may readily arise after the extirpation of a sessile tumor if the technique is imperfect, and it is most liable to occur when the tumor is deep-seated and difficult of access. Under these conditions I lost an elderly woman with a tumor 3 cm. ($1\frac{1}{4}$ inches) in diameter at the fundus, firmly fixed and hard to get at. The tumor was much torn, the removal was incomplete, and in spite of careful cleansing and an intra-uterine pack of iodoform gauze, she died within a week, of sepsis.

Rupture of the Uterus.—The gravest accident liable to occur in removing these growths, when they are sessile and intimately connected with the uterine muscle, is rupture or puncture of the uterine wall. This is most serious when the tumor is out of sight in the uterine cavity, because the injury may take place without its becoming evident. Such an accident, fortunately now quite rare, was much commoner when the spoon saw was used to detach the tumor from its bed.

Rupture has occurred once in my experience, with a fatal result (S. L., J. H. H., No. 1441, June 21, 1892). The tumor, which was about the size of an apple, was situated in the right lateral wall of the uterus, and was removed with great difficulty by torsion and morcellation. The temperature reached 103° F. the day immediately following the operation, but from that time gradually subsided until it became about normal on the seventh day. There was a persistent bloody oozing and several hemorrhages, the largest being about three ounces. The patient then became irritable and complained of sharp pain in the lower abdomen; up to the eleventh day the pulse and temperature continued about normal, when the pulse quickly became very rapid and small and the temperature fell to 96° F.; death ensued within a few hours. The autopsy showed a ragged hole through the uterine wall between the leaves of the broad ligament. Cultures from this area and all the organs were negative.

Anatomical diagnosis of this case: Sapremia; sloughing mass of tissue in the uterus; perforation of uterus into broad ligament; mucous polyp of uterus; submucous myoma; fatty degeneration of heart, liver, and kidneys; general marked anemia.

Death may occur shortly after the operation if the patient is already in a state of profound exhaustion when seen by the surgeon. I lost a feeble old woman, already greatly reduced by hemorrhages, in this way; she had a simple pedunculate fibroid as large as two fists, and its removal was rapidly accomplished without difficulty and without any hemorrhage, but she died simply of exhaustion within twenty-four hours, in spite of all sorts of stimulation.

Polypi.—Polypi are soft growths produced by a hypertrophy of the uterine mucosa, often associated with an endometritis, and frequently found in fibroid uteri. Their histological peculiarities are described in Chapter XX.

The size varies from that of a pea to that of a walnut, and rarely they are larger. Those within the uterine cavity are usually found near the tubal ostia and are more commonly sessile.

Cervical polypi are most frequently pedunculate, and protrude from the external os.

Fig. 371 shows two pedunculate polypi, one extruded into the vagina, as seen upon the left side, while the apex of the other could just be discovered within the slightly dilated cervix.

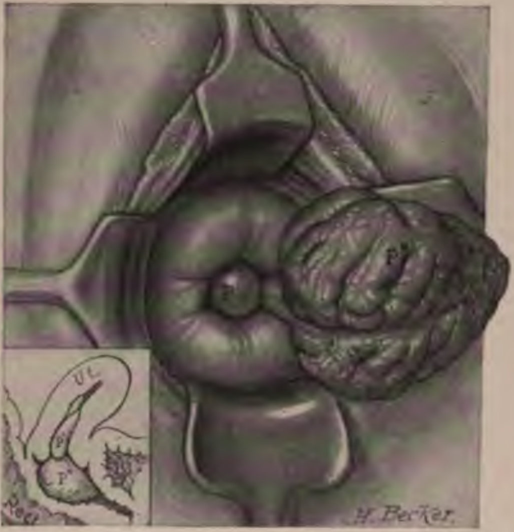

FIG. 371.—TWO UTERINE MUCOUS POLYPI, ONE HANGING IN THE VAGINA WITH AN IRREGULAR FURROWED SURFACE (P'') AND ONE CHOKING THE CERVIX P'.

See figure in corner for intrauterine relations. $\frac{5}{6}$ nat. size. Mrs. R., Ward H. MARCH 7, 1900.

Symptoms.—Hemorrhages are the only clinical sign of polypi. These are rarely severe, and the patients are most often brought to the consultant through the fear of a tumor.

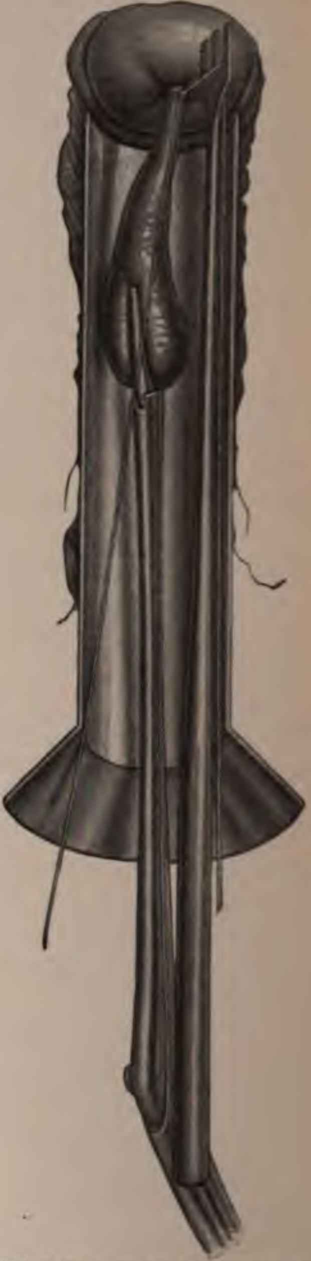

FIG. 372.—METHOD OF REMOVING SUBMU- COUS POLYP WHEN THE HYMEN IS INTACT.

The instrument is the author's larg vesical speculum and is provided with stout handle attached to the funnel porti The polyp is exposed, caught, and snared shown. After ligation the pedicle is and the tumor removed.

These growths should never be neglected, on account of a liability to malig-ant changes. Extirpation and a careful microscopic examination is always ndicated. If the growth is readily accessible the pedicle should be ligated ith a strand of catgut and excised. Those situated higher in the uterine vity can be more easily treated by dilating the cervical canal and removing em, either by torsion or by écraseur, after an application of a 10 per cent lution of cocain to the hymen. In a virginal vagina the polyp can be engaged n a speculum, snared and removed in the manner shown in Fig. 372.

CHAPTER XXV.

THE UTERUS AS A RETENTION CYST.

1. Definition (p. 658).
2. Causes (p. 658).
3. Symptoms (p. 659).
4. Diagnosis (p. 659).
5. Treatment (p. 660): *a.* Hematometra. *b.* Pyometra. *c.* Physometra.

Definition.—The conversion of the uterus into a sac containing fluid or gas is caused by the occlusion of the lower genital tract, at any point from the cervix down. When the uterus alone forms the sac, it is most likely to contain blood during the early childbearing period of life; or pus, and, rarely, pus with gas, during the later childbearing period and after the menopause.

The sac so formed is made up of the more or less thinned-out uterine walls, and is lined everywhere by the uterine mucosa. The formation of such a sac is brought about by the closure of the three avenues by which the uterus communicates with its neighboring cavities—namely, the uterine openings into the uterine tubes and the cervical canal. When the occlusions are found in the vagina and at the outer extremities of the uterine tubes, the uterine retention cyst then forms but one part of a large irregular sac, the rest of which is made up of the vaginal and tubal cavities with free communications from one to the other.

The names of these conditions, applied from the nature of their contents—"hematometra," "pyometra," "hydrometra," and "physometra"—are really misnomers, and will be misleading unless it is expressly borne in mind that the terms are used for clinical convenience, merely to designate a prominent feature of an affection of the cervix or of the vagina. The real disease, on the other hand, is that which affects the closure, and causes the accidental sequelæ of accumulation and distention above it.

The terms pyuria and pyosalpinx, equally unscientific, are used in exactly the same way, purely for clinical convenience.

Causes.—The causes of retention cysts are various. They may be due to congenital malformation of the vagina, or to the occlusion of one-half of a bicornute uterus, or to operative interference with the cervix by knife, cautery, or écraseur, or to an extensive traumatism of the vagina during labor, or to an endocervicitis, or to cancer of the vaginal cervix blocking the canal and preventing the escape of the secretions from the upper part of the cancerous area.

I have found a pyometra above a cervical cancer so often that I always have it in mind, and if a patient complains greatly of pain in the lower abdomen I examine for it carefully. It is evident, as the history of the cases shows, that the accumulation takes place gradually from week to week, or with each menstrual period. In cases of vaginal and cervical atresia following the menopause there is no accumulation above, and no symptoms arise unless there is a senile endometritis. I have seen cervical atresia of this kind in a prolapsed uterus and in a large fibroid uterus. Hennig reckoned that three per cent of all women over the climacteric had this acquired atresia.

The size of the sac will depend upon the activity of the secretion and the length of time the obstruction has lasted. It may be a small one, containing but a few cubic centimeters of fluid, incapable of producing any symptoms, or it may attain a great size, even filling the lower abdomen.

Symptoms.—The symptoms produced arise both from the degree of the distention and the nature of the contents. When the sac is tense, constant pain is felt in the lower abdomen, which is too sore to bear pressure, and with this symptom are apt to be associated urinary and rectal disturbances, together with a variety of nervous phenomena common to many pelvic diseases. The pain itself varies in intensity, and at the menstrual period it is paroxysmal, each attack being accompanied by the most intense suffering.

If the cervical or vaginal passage is not perfectly closed, there will be a little dribbling leakage of pus or blood, evident on inspection. When pus is retained there may be a moderate fever.

Diagnosis.—Upon making a digital examination, the diagnosis is usually easy, if there is a considerable accumulation distending the uterus and it feels like a tense bag; it is more difficult if there is much disease at the point of occlusion and but little accumulation above it, and in this case, as I shall point out, the symptoms deserve a most careful consideration.

To make a thorough examination it is best to put the patient completely under the influence of an anesthetic. The bowels should be well emptied and the bladder catheterized. It also aids greatly in the palpation of a uterine cyst, which may be flaccid and not clear in its outlines, if the patient is first put in the knee-chest position for about three minutes to dislodge the small intestines, skeletonizing the pelvic viscera, as it were. The examination is then continued in the dorsal position.

By the finger inserted in the vagina the point of the occlusion below is fixed as vaginal or cervical, and whether fibrous or cancerous. A vaginal inspection may reveal one or two minute orifices, showing that the closure is not complete.

The extent of the occluded area, whether due to a contraction or a thickening, and the position, size, and relations of the sac itself, must be studied by the bimanual, rectal, and abdominal examination.

With a finger in the vagina and a finger in the rectum, the lower limit of the atresia at which the rectal palpation is to begin is fixed. Then placing the hand on the abdomen, both to furnish a plane of counter-pressure and to aid in palpating, the rectal finger investigates the atretic area above its lower vaginal limit and palpates the uterine body on all sides. A uterus even moderately distended, so as to hold from 50 to 100 c.c. of fluid, lies more or less median and assumes a globular form. Its walls feel tense, rounded, and elastic, often conveying at once the impression of extreme distention.

The dangers of this condition, if left undisturbed, are rupture and general infection; rupture has occurred into the peritoneal cavity, bowel, and bladder. Occasionally such sacs will open spontaneously through the cervical canal.

TREATMENT.

The treatment in all cases is operative, and holds two objects in view:

First, to evacuate the contents of the sac;

Second, to keep a channel of normal caliber open into the vagina to prevent a reaccumulation. (For atresia of the vagina and congenital forms see Chapter XVI.)

The evacuation is always easy, but it is often most difficult to keep the channel patulous in the cervical region.

Hematometra.—Hematometra is an accumulation of blood within the uterine cavity, brought about by a congenital or an acquired occlusion of the cervix, vagina, or hymen.

In operations to remove the cervical stricture the vagina must first be carefully disinfected, and extreme care taken throughout not to convey the slightest infection into the uterine cavity; then, if a small opening exists, a uterine sound is passed in and, assisted by a finger in the rectum, carried up into the sac. If this succeeds, a small-sized dilator is next introduced and the opening enlarged so as to let the fluid out; this is followed by a larger dilator, until the opening is quite patulous; the evacuation of the fluid may be hastened by mopping out the uterine cavity with iodoform gauze. It is not necessary to wash the uterus out—the less done to its cavity the better. An iodoform-gauze pack is put into the vagina and changed every two to four days. After a week or ten days the vault of the vagina is exposed, and a dilator of the Hegar pattern passed up into the uterus. This is repeated every two or three days for some weeks to insure the canal's remaining open.

If the closure is complete, then the sac must be opened by pushing a large trocar and cannula up through the atresia as near as possible in the position of the cervical canal, under the guidance of a finger in the rectum resting on the lower part of the sac. As soon as the trocar is taken out the fluid escapes, and on withdrawing the cannula the dilators of different sizes, from small to large, may be used, so as to open the cervix from side to side well up into the uterine sac. The anterior and posterior lips of the fibrous cervix are then excised and interrupted sutures passed through the part of the uterus just above this, drawing it down and attaching it to the anterior and posterior vaginal walls. A pack is then put into the vagina and the wound allowed to heal.

Pyometra.—Pyometra is usually due to a cancer of the cervix blocking up the canal, or to an endocervicitis causing adhesions between the cervical surfaces. Then pyogenic organisms gain access to the retained fluid, and an accumulation of pus results. I have also seen a large fibroid uterus with an intact mucous surface filled with a pale, thin pus, which poured out on amputating the cervix. Pus in considerable quantities is also often discharged from a large uterus containing a sloughing fibroid tumor. It is my intention here, however, to dwell only upon the cases in which the quantity is sufficient to distend the cavity, forming a retention cyst. The ages of five of my cases of pyometra were fifty-seven, sixty, sixty-one, sixty-two, and sixty-seven years, respectively.

The treatment is first to open up the canal and let out the pus, then wash out thoroughly, drain, and keep the passage open. Where the pyometra is due to a senile endocervicitis, a part of the cervix, or a pit at the vaginal vault, representing the cervical canal, can usually be distinguished in the midst of a granular area. Through this the uterine sound may be passed with slight force, followed by dilators, letting out the pus. The uterine cavity is then washed out with a warm saturated boric acid solution; after this an iodoform-gauze drain should be placed in the uterus, to be removed the next day, after which the cavity is kept open and disinfected by washing it out daily with a 1–10,000 bichloride of mercury solution, using a long, curved glass tube for the douche nozzle. Nitrate of silver solutions of 10 or 5 per cent strength should be applied to any granulating areas about once in five days.

It is not enough simply to dilate the canal and let out the pus, for these cases show a strong tendency to relapse, and must be kept under observation for a long time. The following was a typical case: Mrs. S., sixty-seven years old, had ceased to menstruate at fifty, and had remained perfectly well until within a year, when she was taken with violent pains in the lower part of the abdomen, which she thought were neuralgic. She had fever at the same time, and was so prostrated that she had to go to bed for five weeks, when a slight fetid discharge began to issue from the vagina, and she felt better. This came only when she was up, and was greatest in the morning.

I found a smooth senile vagina and a diminutive cervix with an obliterated canal. The uterus, felt *per rectum,* was tense and globular in form, and as large as a two and a half months' pregnancy. A dilator was easily passed through the closed cervix and 180 c.c. (6 ounces) of thick, fetid green pus escaped. The canal was well dilated and kept open, after which she was at once free from all pain and began to improve. She left me, returning several weeks later with some discomfort, when I found the canal contracted, and let out 30 c.c. (1 ounce) of thick pus mixed with blood. After this the canal was kept open by passing dilators at intervals.

In one case of double pyosalpinx, I found upon removal of the uterus, shown in Fig. 373, that there was also a depôt of pus in the cavity of the uterus, which was prevented from escaping through the cervix by the wide area of occlusion shown.

When cancer of the cervix is the cause of the occlusion and pyometra, the treatment must be different, and is directed both to the cancerous condition as well as to the pyometra. If the disease has not spread too far beyond the uterus a total extirpation must be performed (see Chapters XXXVII and XXXVIII, Vol. II), in this way curing the trouble by removing it. If the cancerous affection is too advanced to admit of this radical treatment, a thorough curettage must be made under anesthesia, removing as much of it as possible, and opening a wide channel up into the uterine cavity.

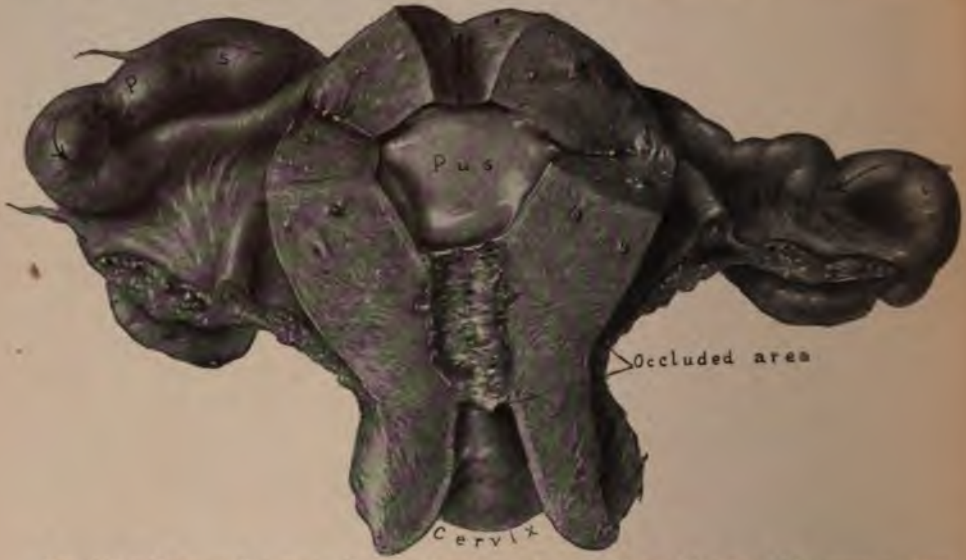

FIG. 373.—CASE OF PYOMETRA DUE TO OCCLUSION OF THE UPPER CERVICAL PORTION OF THE UTERUS.

Note the uterine tubes and corpus filled with pus.

In one of my patients who had a long, irregular cervical canal obstructed by cancer, considerable difficulty was experienced in relieving her of the intense pain attributed to the progress of the malignant disease, until I learned the direction of the canal so well that an irrigating catheter could be passed with ease, and after that the pains disappeared; the irrigation was kept up daily until her death, some months later.

Physometra.—Physometra, or tympany of the uterus, is a term used to designate a collection of gas in the uterus usually found in pregnancy or the puerperal condition, and associated with sepsis. In gynecological cases the physometra is a rare accompaniment of a pyometra, probably due to the presence of gas-producing bacilli.

I have seen but three cases of physometra, two complicating large sloughing submucous fibroids, and one associated with a pyometra due to a cancerous cervix.

Physometra Due to Cancer.—The patient was a black woman, sixty-one years of age, sent me by Dr. C. M. Cheston, of West River, Md., in July, 1890. Although she ceased to menstruate ten years before, she had had hemorrhages for two years. She had no leucorrhea, but complained of a burning feeling across the back and abdomen, and the hemorrhages, which continued, as a rule, for two days, were followed by a watery discharge. She had several times been insane.

The cervix was high up in the vagina and fixed to the left pelvic wall; on its right side, easily felt through the vagina and thin abdominal walls, was a globular fluctuant tumor, about 10 cm. (4 inches) in diameter. The cervix was the seat of a cancerous degeneration measuring 3 cm. (1¼ inches) in diameter, from which numerous shreds of tissue hung down into the vagina with excavated areas between them, freely bleeding when touched. The cancerous tissue was first broken down with the fingers, followed by a sharp curette,

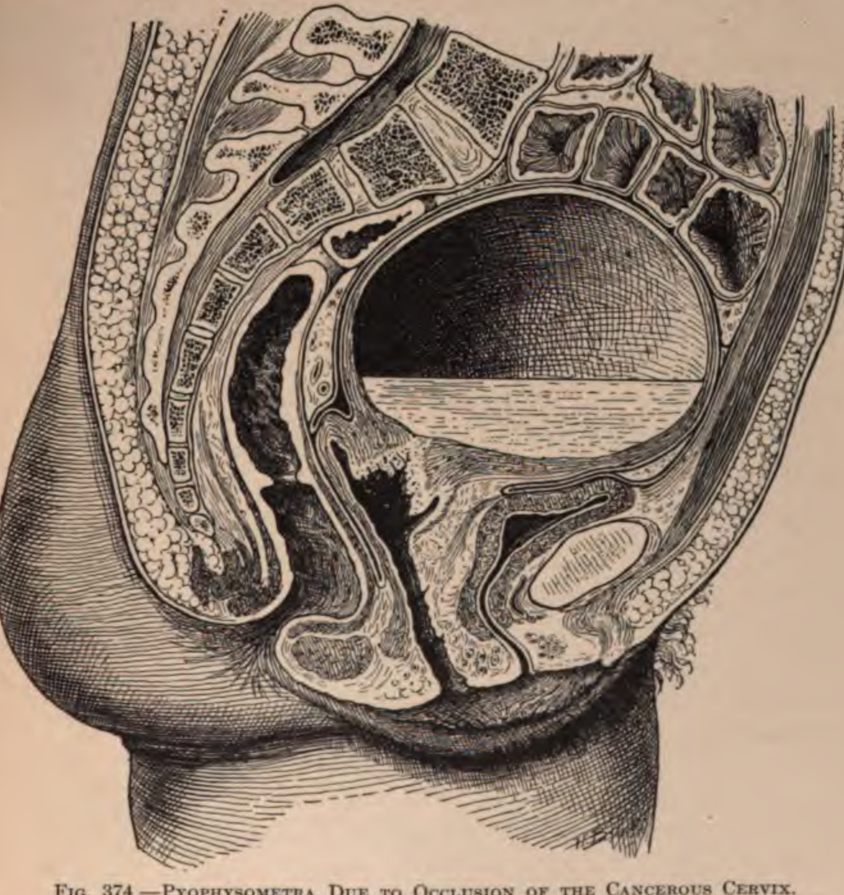

FIG. 374.—PYOPHYSOMETRA DUE TO OCCLUSION OF THE CANCEROUS CERVIX.

Note the thin distended uterine wall, containing pus in the lower part of its cavity, with a large gas space above. An explosion of gas took place as soon as the instrument broke through the barrier at the cervix.

and the base, which was superficial, was thoroughly cauterized; it appeared to be one of the slow-growing cancers of old age.

On making a bimanual examination to locate the fundus, the vaginal finger suddenly entered a large smooth cavity, and this was signalized by an audible report like the pop of a gun, with a rush of gas out of the sac, followed by 90 c.c. of thick, intensely fetid pus (pyophysometra). (See Fig. 374.)

The body of the uterus was distended to the size of a four months' pregnancy and its thin walls collapsed without contracting. The sac was douched out with a weak bichloride solution, and the vagina packed with iodoform gauze.

During her convalescence the patient became actively delirious and left for home in twelve days; she subsequently died in an insane asylum.

Physometra Due to Sloughing Fibroid Tumors.—In January, 1887, I saw a colored woman, a patient of Dr. H. Williams, of Philadelphia, who was extremely emaciated and hectic, with a dry tongue and a pulse of 140. The abdomen was as large as that of a woman eight months pregnant, tense and tender. Palpation showed that the uterus was converted into a mass of fibroid tumors, but the percussion note over the mass was tympanitic. At the operation I introduced my hand into the uterine cavity and easily removed a sloughing fibroid which would fill a one and a half liter measure, and then broke through the thin septum of a second, large, sessile, fibroid tumor, when two liters of intensely fetid pus escaped, with large quantities of gas. The pulse after the operation was 184; the patient was free from pain and lost no blood, but she died a week later worn out by the prolonged suppuration.

Physometra in Pregnancy.—The commonest of all forms of physometra is that met with in pregnancy or in the puerperium. It is oftenest observed in women with narrow pelves, where labor is protracted and where manual or other operative interference has been found necessary, and it is always due to an infection by a gas-producing bacillus.

It is still the common impression that the gas in the uterus is due to the entrance or introduction of air from without, or to the formation of gas blebs in a dead fetus macerated in a moist medium. For example, C. Bamberg (*Inaug. Dissert.*, Halle, 1877) reports the case of a primipara with prolapse of the cord, in which the patient was put in the knee-elbow posture and the cord replaced. The next day the patient had a chill, the pulse rose to 124, and the temperature to 41.4° C.; percussion over the uterus yielded perfect tympanitic resonance. The child was perforated and delivered, and after the escape of the head a quantity of extremely foul gases poured out of the vagina with the fetid waters.

The child under such circumstances is always dead, and the waters, as a rule, ruptured, when the tympanites is found.

The true cause of the tympany is the **bacillus aërogenes capsulatus**, and this is well shown by a case investigated by Dr. George W. Dobbin, the first case in which the bacillus has been demonstrated ante-mortem (" Puerperal

Sepsis Due to Infection with the Bacillus Aërogenes Capsulatus," *Johns Hopkins Hospital Bulletin*, Feb., 1897).

The patient, a Polish woman, had been in labor for two days, attended by a midwife. She was found by Dr. Dobbin in a state of extreme exhaustion, with a pulse of 130 to 140, and with a large dead fetus impacted in a pelvis, with a true conjugate measuring approximately 8 cm. (3⅛ inches). There were no regular labor pains, and there was a continuous escape of gas and frothy fluid from the vagina. A sweetish, offensive odor was noticeable about the bed, and a distinct bubbling, crackling sound could be heard. The child was delivered by a craniotomy, and immediately following the delivery a large amount of offensive gas escaped from the uterine cavity. Great numbers of the bacillus aërogenes capsulatus were demonstrated in the fetus, placenta, and uterine lochia, and a fatal prognosis was given.

Death occurred on the third day after delivery. No autopsy was allowed. Dr. S. Flexner saw the patient six to eight hours before death, and endeavored in vain to find any evidences of the formation of gas in the tissues remote from the genitalia. But six or seven hours after death the appearances presented were those of extensive gas formation everywhere in the soft tissues and serous cavities, while from the nose and mouth frothy bloody serum exuded, which in cover-slip preparations showed the characteristic bacilli.

This is a confirmation of the prediction made by Welch and Nuttall that many of the cases of supposed entrance of air into the uterine sinuses would be found to be due to infection with a gas-producing micro-organism.

The diagnosis is made by percussing the tympanitic, distended uterus, and is sometimes helped by noticing the escape of fetid waters mingled with little gas bubbles. The uterus may contain a small quantity of gas, which always assumes the highest position in turning the patient; in other cases the uterus is so distended that the danger of rupture seems imminent, and breathing is greatly embarrassed by pressure on the diaphragm.

The treatment is to empty the uterus as soon as possible, without reference to the child, which is already dead, and then to wash out the uterine cavity with an antiseptic douche, such as carbolic acid, 3 per cent, and to repeat the douches frequently enough to sterilize and keep sterile the genital tract.

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